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So many objects, so little time

Welcome to *Astronomy*'s first-ever special issue devoted to deep-sky objects. I planned this publication to complement *Atlas of the stars*, which debuted in May 2006. Whereas *Atlas* is your "road map" to the sky, this publication is a guide to the sky's top 100 roadside attractions. ☾ These objects motivate amateur astronomers to seek the darkest observing sites. And, especially at star parties and public observing sessions, these 100 standout celestial showpieces are the ones most likely to garner a "Wow!" response.

Picking the top 100 deep-sky wonders was fun until I'd chosen 99 and realized I had some 50 objects vying for the last slot. Some choices were obvious: I couldn't omit the Orion Nebula (M42) or the Andromeda Galaxy (M31). Other choices were tougher: Do I pick M66 or M94; or, do I keep both galaxies and eliminate a star cluster or nebula? I omitted some objects — including a few of my favorites — for practical reasons. The Witch Head Nebula (IC 2118), for example, glows too faintly through even medium-sized scopes.

The final "wonder" tally finds nebulae winning with 42 entries. When we break down the subcategories, emission nebulae number 24, planetary nebulae 12, dark nebulae 4, and reflection nebulae 2. Galaxies are the next most populous entry, with an overall count of 33. The galaxies include 23 spirals, a single elliptical, six irregulars, and three groups.

I included 20 star clusters, 14 open and 6 globular. Rounding out the list are three supernova remnants and two sky regions that have a lot going on — those around Rho (ρ) Ophiuchi and Gamma (γ) Cygni.

This guide presents the celestial objects chronologically through the year based on each object's best visibility date. I calculated these dates by determining when the Sun's position (right ascension) placed it 180° from each object. On each of the given dates, therefore, the object will rise at sunset and appear highest in the sky at the middle of the night (not necessarily 12 A.M.), when the sky is darkest.

I chose targets suitable for viewing through a range of telescope sizes. A few, like the Pleiades (M45) and the Double Cluster in Perseus (NGC 869 and NGC 884), look better through 10x to 15x binoculars than through most telescopes. That's because binoculars offer a wide field of view and capture the whole object.

Open clusters and the brightest nebulae make good targets for telescopes less than 4 inches. Through medium-sized (4- to 8-inch) telescopes, globular clusters begin to resolve into stars, and galaxies come into play from a dark site. Also, such scopes offer enough light throughput to open up the realm of nebula filters. Although no filter makes any object brighter, nebulae will be easier to see because filters increase contrast and dim stars.

For our readers without telescopes and for those who prefer "armchair" astronomy, this guide can function as a tour through the universe. Here, you'll discover why some nebulae appear "planetary," what processes sculpt nebulae into various shapes, how stars end their lives, and what drives star formation in certain galaxies. Each object tells a tale, and, together, these stories explain much about the nature of the universe in which Earth is just a pale blue dot.

Michael E Bakich

Michael E. Bakich
Editor

100 MOST SPECTACULAR
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by Michael E. Bakich

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How to observe deep-sky objects

Even if you're new to astronomy, you can zero in on nebulae, star clusters, and galaxies. Here are some observing tips to help you get started. You'll find additional techniques in this magazine's 100 object descriptions. Keep an eye out for even more observing stories in each issue of *Astronomy* magazine.

Nebulae: Filters really help

Use the biggest telescope you can when observing nebulae (clouds of dust and gas). The light throughput of larger scopes allows you to use filters, which pass certain wavelengths of light, but block the rest. When used with small scopes, filters cut out too much light.

Filters labeled "Deep-sky," "LPR" (light pollution reduction), and "UHC" (ultra-high contrast) improve your view of emission nebulae. Don't use a filter on reflection nebulae because you'll only dim the object. Those objects simply reflect and scatter starlight, which comprises all wavelengths.

Dark nebulae are clouds of dust grains and cold gas obscuring light from stars or nebulae behind them. Don't use filters when you observe dark nebulae because you'll want the full effect from the light behind them.

A planetary nebula forms when a Sun-like star ejects its outer layers near the end of its life as an expanding shell of cool, thin gas. Filters labeled "OIII" work best for planetary nebulae.

The dominant color of planetaries lies close to the border between what we see as green and blue. So, even slight differences in a person's color response could cause two observers to see different colors in the same object.

THE ETA CARINAE NEBULA (NGC 3372) floats in the southern constellation Carina the Keel. To observe it, northern observers must head south. Find this wonder on page 19. TONY AND DAPHNE HALLAS

Star clusters: Look closely for patterns

A star cluster is a group of stars held together by gravity. The two main types are open clusters and globular clusters.

Open clusters are large, so start with low-power eyepieces. Discern which stars belong to the cluster and which simply lie in the field of view. This can be tricky when the cluster lies against the Milky Way. Big telescopes sometimes hinder the identification of cluster stars, because they reveal so many background stars.

No group of objects excites new observers more than globular clusters. You can spot the 20 brightest even from light-polluted locations. From a dark site, globulars explode with detail. Use high magnification, and watch fuzz resolve into points of light that form intricate patterns.

Look for streamers extending out from the nucleus (the cluster's center). Observe the cluster's concentration, its richness, and the range of star brightnesses.

DON'T OVERLOOK NGC 891 in Andromeda the Princess just because the Andromeda Galaxy (M31) lies in the same constellation. Read more about this wonder on page 82. R. JAY GABANY

Galaxies: Head to a dark site

Galaxies may be the most intriguing class of objects, but, except for a few exceptions, they appear small and faint. Plan your sessions so you're observing each of these elusive objects when it sits highest in the sky and you're seeing it through the least amount of atmosphere.

Begin by noting the galaxy's shape. Look for a central condensation or other bright areas. How does the galaxy, or its nucleus, compare with the field stars? Experience at the eyepiece is most important for galaxies. What looks like a blob to beginning observers eventually will reveal a wealth of details, albeit faint.

Galaxies contain all types of objects, so any filter will dim your view. As with all deep-sky wonders, observe galaxies from the darkest possible location. A 6-inch telescope under a dark sky will beat a 12-inch instrument in a light-polluted area every time.

Star chart legend

◌	Open cluster	α	Alpha	η	Eta	ν	Nu	τ	Tau
⊕	Globular cluster	β	Beta	θ	Theta	ξ	Xi	υ	Upsilon
☐	Diffuse nebula	γ	Gamma	ι	Iota	ο	Omicron	φ	Phi
-⊙-	Planetary nebula	δ	Delta	κ	Kappa	π	Pi	χ	Chi
⬭	Galaxy	ε	Epsilon	λ	Lambda	ρ	Rho	ψ	Psi
		ζ	Zeta	μ	Mu	σ	Sigma	ω	Omega

Best seen: **JANUARY 2**

1 M41

Open cluster in Canis Major

OPEN CLUSTER M41 **in Canis Major is a naked-eye object 4° south of the sky's brightest star, Sirius (Alpha [α] Canis Majoris). Through a telescope, use low magnification.** TOM DIANA

M41 statistics

Also known as: NGC 2287
Right ascension: 6h46m
Declination: –20°46'
Magnitude: 4.5
Apparent size: 38'
Distance: 2,300 light-years
Visible: South of latitude 69° N.

Our first object is one of the easiest deep-sky targets because we can use the sky's brightest star as a guide to it. Open cluster M41 lies 4° south of Sirius (Alpha [α] Canis Majoris). From a dark site, you'll easily spot M41 with your naked eyes.

Through a 6-inch telescope, you'll see about 50 stars. With twice the aperture, you'll dramatically increase the number of stars. Star counts by astronomers indicate M41 contains more than 100 stars strewn over an area slightly larger than the Full Moon. M41's stars range in brightness from magnitude 7 to 13.

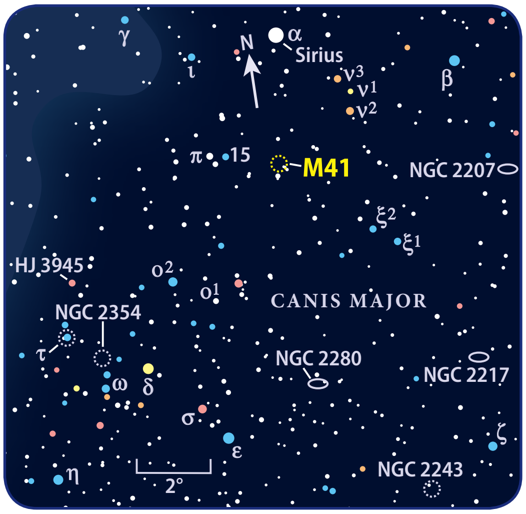
The brightest star in the field of view, 12 Canis Majoris, does not belong to the cluster. At a distance of 1,100 light-years, 12 CMa lies less than half as far away as M41. This magnitude 6.1 star sits 21' southeast of M41's center.

At first glance, this cluster appears roughly circular. Closer inspection reveals several chains of stars running north-south. Through binoculars or a low-power telescope/eyepiece combination, look for these curving arrangements.

Italian astronomer Giovanni Battista Hodierna (1597–1660) discovered this cluster before 1654, when he published a catalog of celestial objects. But Greek philosopher Aristotle (384–322 B.C.) mentioned it around 325 B.C. as one of the sky's unresolved "cloudy spots." Because astronomers can measure M41's distance and apparent size, they can calculate its true diameter — 25 light-years.

French comet-hunter Charles Messier (1730–1817) added this cluster to his list of non-comets with this description: "A cluster of stars below Sirius; this cluster appears nebulous in an ordinary telescope of one foot [focal length]; it is nothing more than a cluster of small stars."

One feature that sets M41 apart from most open clusters is its several cool giant stars, which usually don't appear in this type of cluster.



FINDING M41 **isn't difficult. Just drop down from the Dog Star, Sirius, about one binocular field of view.** ALL ILLUSTRATIONS: *ASTRONOMY*: ROEN KELLY

Look for these celestial targets nearby:

ANTHONY AYIOMAMITIS

- ››› **M50,** a magnitude 5.9 open cluster, lies 13° north-northeast.
- ››› **M93,** a magnitude 6.2 open cluster, lies 14° east-southeast.
- ››› **NGC 2298,** a magnitude 9.3 globular cluster, lies 15° south.
- ››› **TOMBAUGH 1,** a magnitude 10.5 open cluster, lies 3.7° east-northeast.

IF YOU LIKE THIS OBJECT, be sure to observe:
The Beehive Cluster (M44) — page 12 • The Owl Cluster (NGC 457) — page 79 • The Salt and Pepper Cluster (M37) — page 95

Best seen: **JANUARY 9**

2 Thor's Helmet

Emission and reflection nebula in Canis Major

Thor's Helmet statistics

Also known as: the Duck Nebula and NGC 2359
Right ascension: 7h19m
Declination: –13°12'
Magnitude: —
Apparent size: 8'
Distance: 16,000 light-years
Visible: South of latitude 76° N.

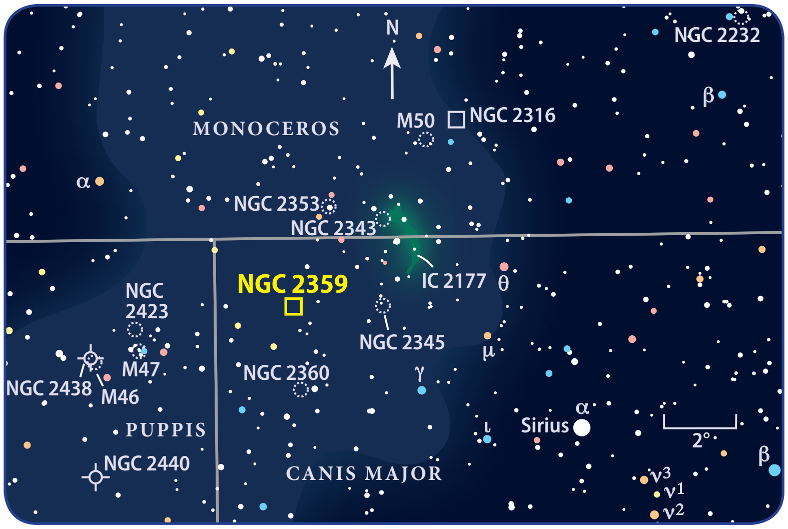
Thor's Helmet — perhaps the most impressive name for any deep-sky object — is a cosmic bubble sculpted by radiation from a type of luminous, massive star called a Wolf-Rayet star.

French astronomers Charles Joseph Étienne Wolf (1827–1918) and Georges Antoine Pons Rayet (1839–1906) discovered this stellar type spectroscopically in 1867. These short-lived supergiant stars are rare; astronomers have discovered fewer than 250 of them within the Milky Way.

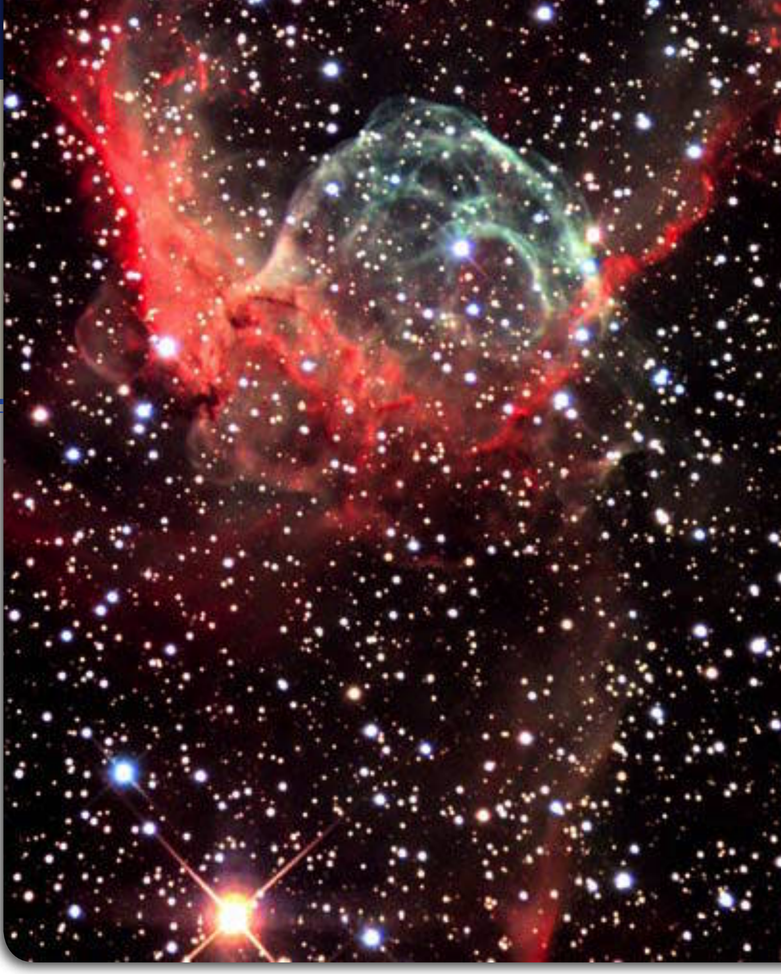
As the star enters the Wolf-Rayet stage, a powerful stellar wind of up to 6 million mph (10 million km/h) ejects the star's outer envelope. This gas slams into the surrounding interstellar medium and sculpts a beautiful shell of ionized gas.

NGC 2359 lies 8.8° east-northeast of Canis Major's brightest star, Sirius. The nebula responds well to narrowband and nebula filters. Through a 12-inch telescope, you'll see the circular central area and the helmet's two "wings." The brightest part measures 1' wide and extends to the south approximately 4'.

Recently, I observed Thor's Helmet through a 30-inch telescope. The intricate details I thought visible only in photographs amazed me. If you have the opportunity to observe NGC 2359 through a large telescope, you won't be disappointed. 100



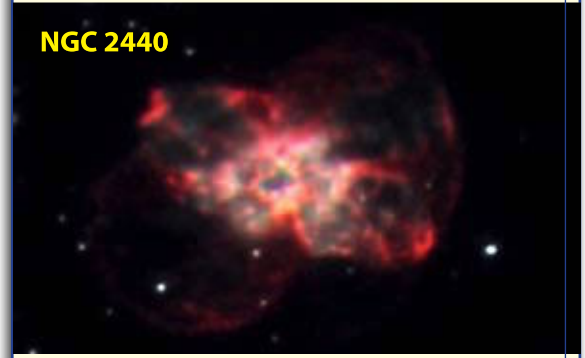
THOR'S HELMET lies in a rich Milky Way region just south of Canis Major's border with the constellation Monoceros.



THOR'S HELMET (NGC 2359) in Canis Major glows because radiation from a hot star at its center interacts with the gas surrounding it.

PETER AND SUZIE ERICKSON/ADAM BLOCK/NOAO/AURA/NSF

Look for these celestial targets nearby:



CHRIS SCHUR

- **M48,** a magnitude 5.8 open cluster, lies 15.5° east-northeast.
- **NGC 2335,** a magnitude 7.2 open cluster, lies 4° northwest.
- **NGC 2396,** a magnitude 7.4 open cluster, lies 2.8° east-northeast.
- **NGC 2440,** a magnitude 9.4 planetary nebula, lies 7.5° southeast.

IF YOU LIKE THIS OBJECT, be sure to observe:
The Lobster Nebula (NGC 6537) — page 46 • The Crescent Nebula (NGC 6888) — page 58 • The Orion Nebula (M42) — page 92

Best seen: **JANUARY 9**

3

The Tau Canis Majoris Cluster

Open cluster in Canis Major

THE TAU CANIS MAJORIS CLUSTER (NGC 2362) sometimes gets overlooked by Northern Hemisphere observers, even though it's the sky's ninth-brightest open cluster. Most of the cluster's light comes from its namesake star. TIM HUNTER

Tau Canis Majoris Cluster statistics

Also known as: NGC 2362 and Caldwell 64

Right ascension: 7h19m

Declination: –24°57'

Magnitude: 3.8

Apparent size: 6'

Distance: 4,500 light-years

Visible: South of latitude 65° N.

Our third object, which also lies within the constellation Canis Major, ranks as the sky's ninth-brightest open cluster. Named for the brightest star within it, the Tau Canis Majoris Cluster contains magnitude 4.4 Tau (τ) CMa and lots of fainter stars. In fact, no cluster star shines within 3 magnitudes of Tau.

Tau is one of the most luminous supergiants known. Its absolute magnitude (the brightness it would have if its distance were 32.6 light-years) is –7. That makes it roughly 50,000 times brighter than the Sun.

Best seen: **JANUARY 12**

4

The Eskimo Nebula

Planetary nebula in Gemini

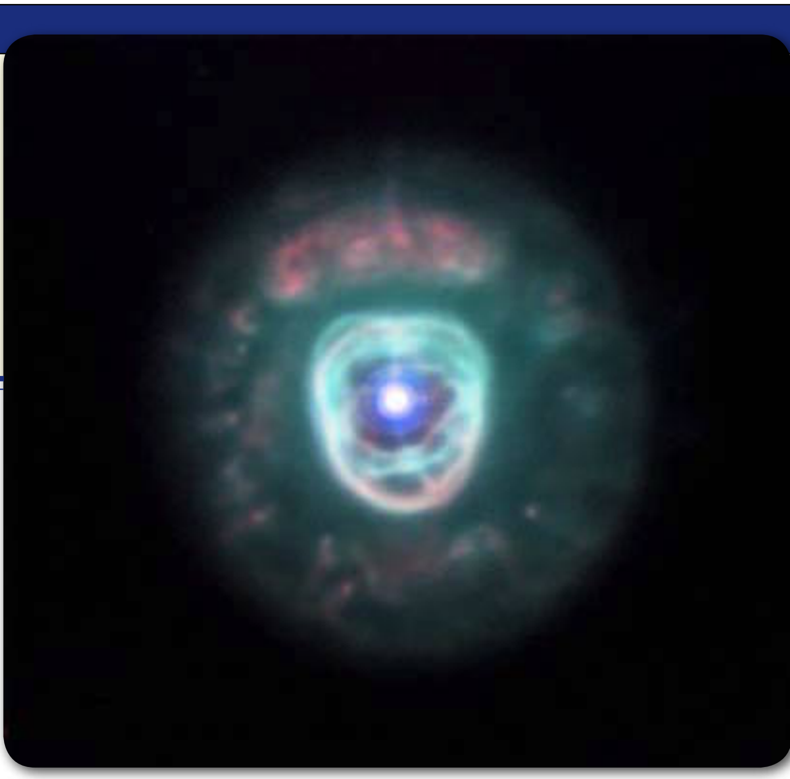
Planetary nebulae represent a brief but beautiful step in the evolution of Sun-like stars. When a star like the Sun dies, its outer layers expand to form a planetary nebula.

Within a relatively brief span — 10,000 years — the nebula will disperse into space. Subsequently, the star's core will cool and fade for billions of years.

The core, now no longer producing energy by nuclear reactions, shrinks to about the size of Earth because of gravitational collapse. Astronomers call such an object a white dwarf. White dwarfs contain up to 1.4 solar-masses, and their surfaces measure in the tens of thousands of degrees Fahrenheit.

Because white dwarfs are so dense, it will take roughly a trillion years for the star to radiate all its heat away. After that, it will drift through space as a black dwarf.

The Eskimo Nebula resembles a face surrounded by a fur parka. The "parka" is a disk that contains a ring of comet-shaped gas clouds, with their tails streaming away from the



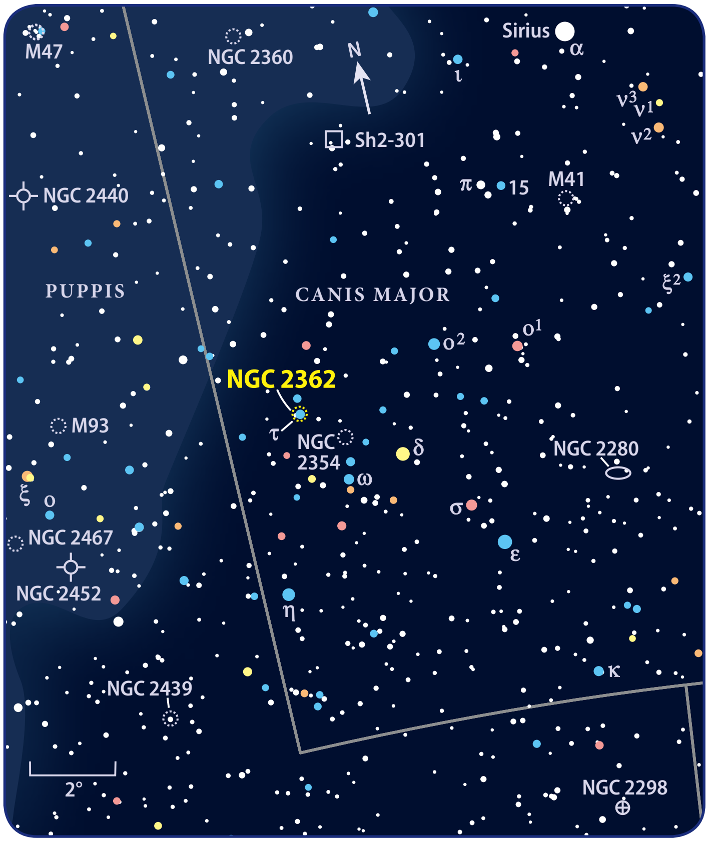
THE ESKIMO NEBULA (NGC 2392) is a planetary nebula in Gemini. If the seeing (atmospheric steadiness) is good, use magnifications above 200x, and you may spot the two-ringed structure through an 8-inch or larger telescope. PETER AND SUZIE ERICKSON/ADAM BLOCK/NOAO/AURA/NSF

IF YOU LIKE THIS OBJECT, be sure to observe:
The Jewel Box (NGC 4755) — page 32 • The Northern Jewel Box (NGC 6231) — page 43 • The Pleiades (M45) — page 87

To locate NGC 2362, find magnitude 1.8 Wezen (Delta [δ] Canis Majoris), and move 2.8° northeast. You'll spot the cluster easily with your naked eyes. Use binoculars, and you'll see that stars pack this area of the winter Milky Way.

Through a telescope, Tau dominates the view, partially obscuring many of the 10th-magnitude stars surrounding it. To get an accurate count of the stars in NGC 2362, place Tau just outside the field of view, first to the north, then to each of the other three cardinal directions. Then simply count the suddenly visible fainter stars, and add the four numbers together.

Giovanni Batista Hodierna discovered this cluster sometime before 1654. His deep-sky discoveries remained unknown, however, until the early 1980s. English astronomer Sir William Herschel (1738–1822) independently discovered NGC 2362 March 4, 1783.



WHEN YOU FIRST SEE the Tau Canis Majoris Cluster (NGC 2362), it may appear fuzzy because the faint stars surrounding Tau CMa create a slight glow.

Look for these celestial targets nearby:

››› **NGC 2217,** a magnitude 10.7 spiral galaxy, lies 13° west.

››› **NGC 2280,** a magnitude 10.5 spiral galaxy, lies 8° west-southwest.

››› **NGC 2354,** a magnitude 6.5 open cluster, lies 1.3° southwest.

››› **NGC 2439,** a magnitude 6.9 open cluster, lies 8.3° southeast.

white-dwarf star at the center. The Eskimo's "face" is a bubble of material being blown into space by the central star's intense 900,000 mph (1.5 million km/h) wind.

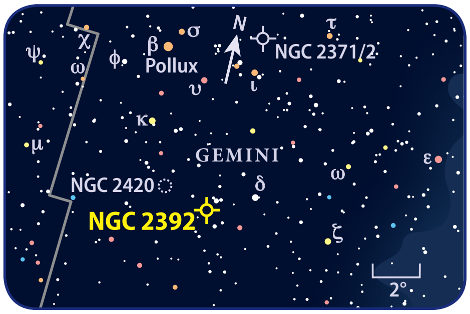
The planetary nebula formed 10,000 years ago when the star ejected its atmosphere. The nebula contains two elliptical lobes of matter streaming above and below the star. The closer bubble obscures part of the second lobe. The bubbles are not smooth but have filaments of denser matter. Each bubble is about 1 light-year long.

Seeing detail in the Eskimo Nebula is easy. If sky conditions warrant, use high magnification. This blue, magnitude 9.1 planetary makes a great target through 8-inch or larger telescopes. Seeing the magnitude 10 central star poses no problem.

NGC 2392's double-shell appearance results from its nearly pole-on orientation to Earth. The inner shell appears bright, with a mottled texture. The outer shell looks fainter than the inner one, and a dark ring separates the two. The outer shell also dims with increasing distance from the central star.

Eskimo Nebula statistics

Also known as: Clown-Face Nebula, NGC 2392, and Caldwell 39
Right ascension: 7h29m
Declination: 20°55'
Magnitude: 9.1
Apparent size: 0.7'
Distance: 3,000 light-years
Visible: North of latitude 69° S.



FIND THE ESKIMO NEBULA by locating Wasat (Delta [δ] Geminorum. Then move 2.4° east-southeast.

Look for these celestial targets nearby:

››› **NGC 2339,** a magnitude 11.6 spiral galaxy, lies 5.3° west-southwest.

››› **NGC 2419,** a magnitude 10.3 globular cluster, lies 18° north.

››› **NGC 2420,** a magnitude 8.3 open cluster, lies 2.3° east-northeast.

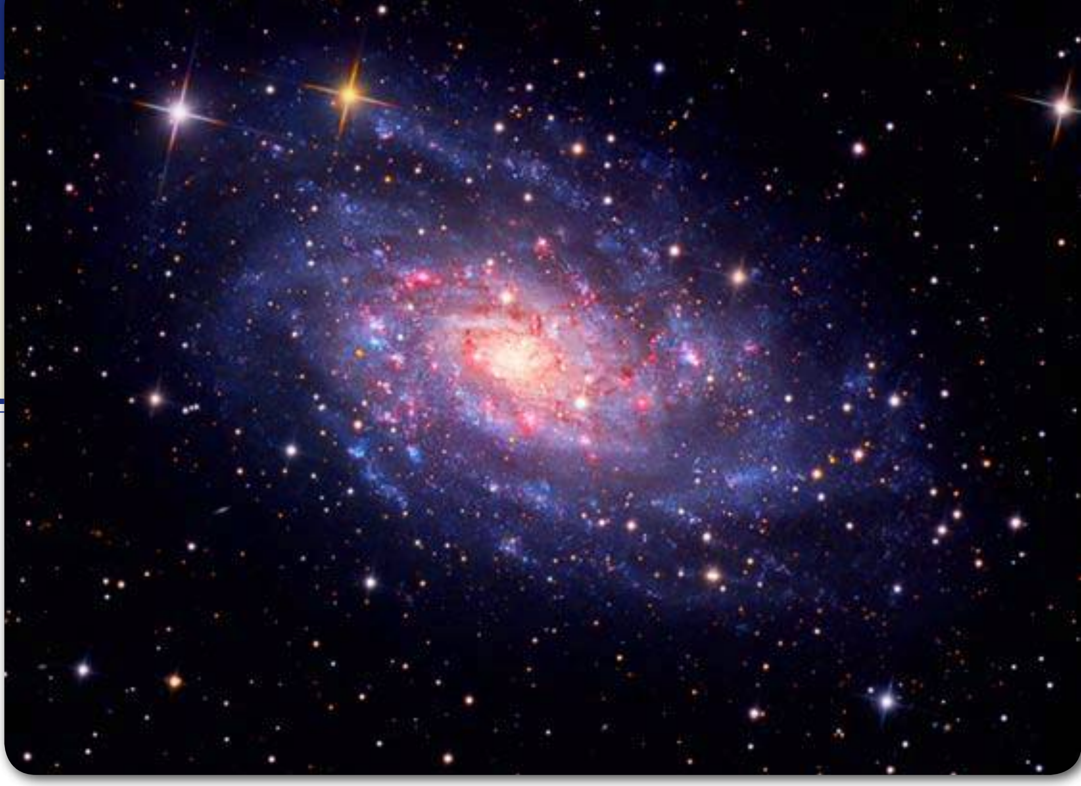
››› **THE MEDUSA NEBULA (ABELL 21),** a magnitude 10.3 planetary nebula, lies 7.7° south.

IF YOU LIKE THIS OBJECT, be sure to observe:
The Owl Nebula (M97) — page 20 • The Ring Nebula (M57) — page 52 • The Helix Nebula (NGC 7293) — page 68

Best seen: **JANUARY 13**

5 NGC 2403

Spiral galaxy in Camelopardalis



SPIRAL GALAXY NGC 2403 in Camelopardalis moves through space with the galaxy M81 (not shown) in Ursa Major. The red patches in NGC 2403 are glowing hydrogen clouds. TONY AND DAPHNE HALLAS

NGC 2403 statistics

Also known as: Caldwell 7
Right ascension: 7h37m
Declination: 65°36'
Magnitude: 8.4
Apparent size: 18' by 11'
Distance: 12 million light-years
Visible: North of latitude 24° S.

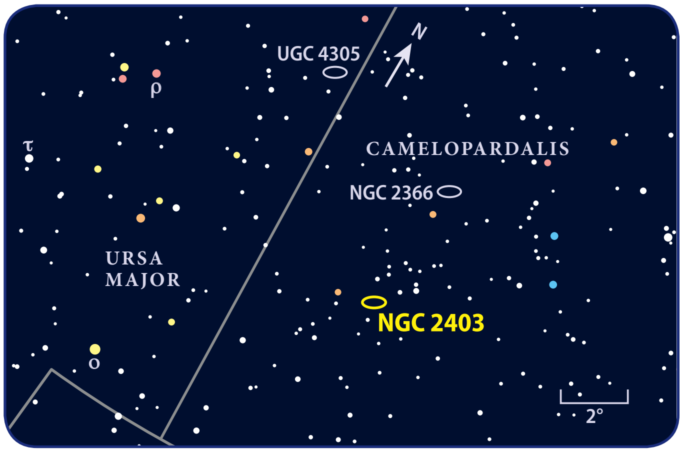
The first galaxy in our "top 100" list sits in the little-known northern constellation Camelopardalis the Giraffe. Dutch mapmaker Petrus Plancius (1552–1622) invented this star group and placed it on a celestial globe in 1613. Camelopardalis contains no star brighter than 4th magnitude.

NGC 2403 lies more than three times as distant as any galaxy in the Local Group, the collection of about 40 nearby galaxies that contains the Milky Way and Andromeda galaxies (M31). NGC 2403 was the first galaxy outside the Local Group where astronomers discovered Cepheid variable stars. Cepheids have a relationship between their periods of variability and their brightnesses that allows astronomers to calculate their distances precisely.

Notice the resemblance between NGC 2403 and the Pinwheel Galaxy (M33) in Triangulum (page 80). Each galaxy has a small nucleus, and irregular spiral arms surround it.

Small telescopes show NGC 2403 as an indistinct haze roughly twice as long as wide, with a bright central region. Through a 12-inch scope, you'll begin to see the galaxy's spiral arms, but you'll need an even larger instrument to trace them all the way back to the nucleus.

Look for stellar associations in NGC 2403's arms. Associations are a type of star cluster resembling open clusters but holding only up to about 100 stars. Associations also are much larger than open clusters. Associations may span 100 light-years. Astronomers believe associations last only a few tens of millions of years before the individual stars go their separate ways. The presence of these clusters indicates star formation is ongoing within NGC 2403. 100



NGC 2403 lies in an unremarkable section of sky. The nearest bright star is magnitude 3.4 Muscida (Omicron [ο] Ursae Majoris). To find NGC 2403, move 7.7° northwest of Muscida.

JEFF HAPEMAN/ADAM BLOCK/NOAO/AURA/NSF

Look for these celestial targets nearby:

- **NGC 2146,** a magnitude 10.5 spiral galaxy, lies 14° north-northwest.
- **NGC 2366,** a magnitude 10.9 irregular galaxy, lies 3.8° north-northwest.
- **NGC 2655,** a magnitude 10.1 spiral galaxy, lies 14° north-northeast.
- **UGC 4305,** a magnitude 11.1 irregular galaxy, lies 6.5° north-northeast.

IF YOU LIKE THIS OBJECT, be sure to observe:
Bode's Galaxy (M81) — page 15 • **M106** — page 22 • **M94** — page 30

Best seen: **JANUARY 15**

6 M46

Open cluster in Puppis

Puppis the Stern is a bright constellation lying south and east of better-known Canis Major. One way to find Puppis is to use Orion's Belt, draw a line downward to the sky's brightest star, Sirius, and continue the line an equal distance. That puts you in the heart of Puppis.

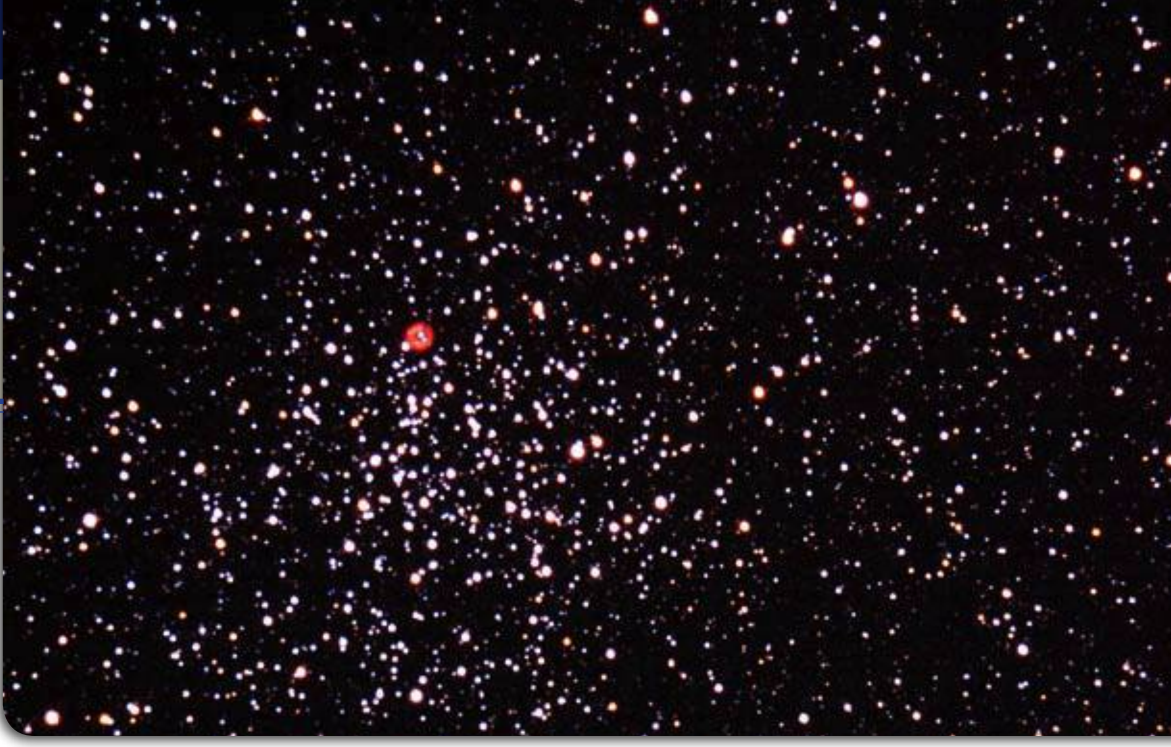
Several open clusters within Puppis are more prominent than M46. M47, for example, outshines M46 by more than a magnitude and a half. NGC 2451, which lies some 23° south of M46 (a tough catch for Northern Hemisphere observers), is more than 3 magnitudes brighter. Why, then, did M46 make the "top 100"? Point a 4-inch or larger telescope its way, and you'll see.

Within the boundaries of M46 resides planetary nebula NGC 2438. It sits 7' north of the cluster's center and measures about 1' across. Use high magnification, and you may detect the planetary's donut-like appearance. Several visible stars lie within the donut, but none is the central star, which glows dimly at magnitude 17.7.

Most astronomers agree NGC 2438 is a foreground object, somewhat fortunately superimposed upon M46. Calculations place NGC 2438 several thousand light-years closer than M46.

The star cluster, discovered by Charles Messier in 1771, contains several hundred stars. You'll see 100 of them through an 8-inch telescope. The stars appear evenly distributed throughout a circle slightly less than half a degree across.

Look closely, however, and you'll see a slightly denser concentration of stars at M46's southern edge. A dark lane separates this region from the rest of the cluster. 100

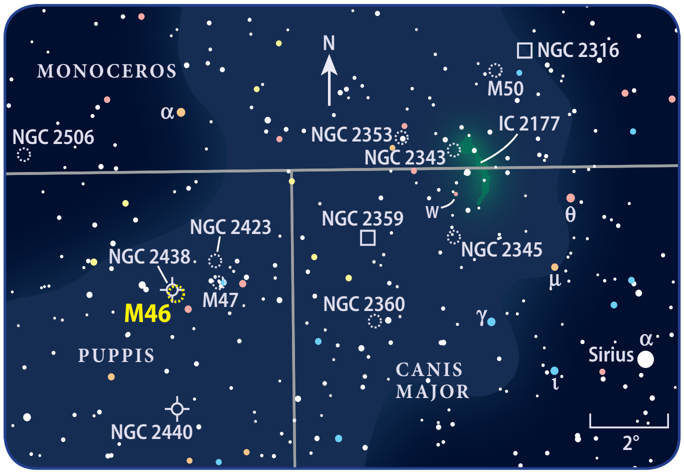


OPEN CLUSTER M46 in Puppis holds a surprise — planetary nebula NGC 2438. The red planetary doesn't belong to the cluster; rather, it's superimposed on M46's stars. LEE C. COOMBS

ANTHONY AYIOMAMITIS

Look for these celestial targets nearby:

- ››› **M47,** a magnitude 4.4 open cluster, lies 1.3° west.
- ››› **NGC 2414,** a magnitude 7.9 open cluster, lies 2° west-southwest.
- ››› **NGC 2423,** a magnitude 6.7 open cluster, lies 1.5° northwest.
- ››› **CZERNIK 29,** a magnitude 10.3 open cluster, lies 3.3° west.



DON'T CONFUSE M46 with nearby open cluster M47, which is slightly larger and brighter.

M46 statistics

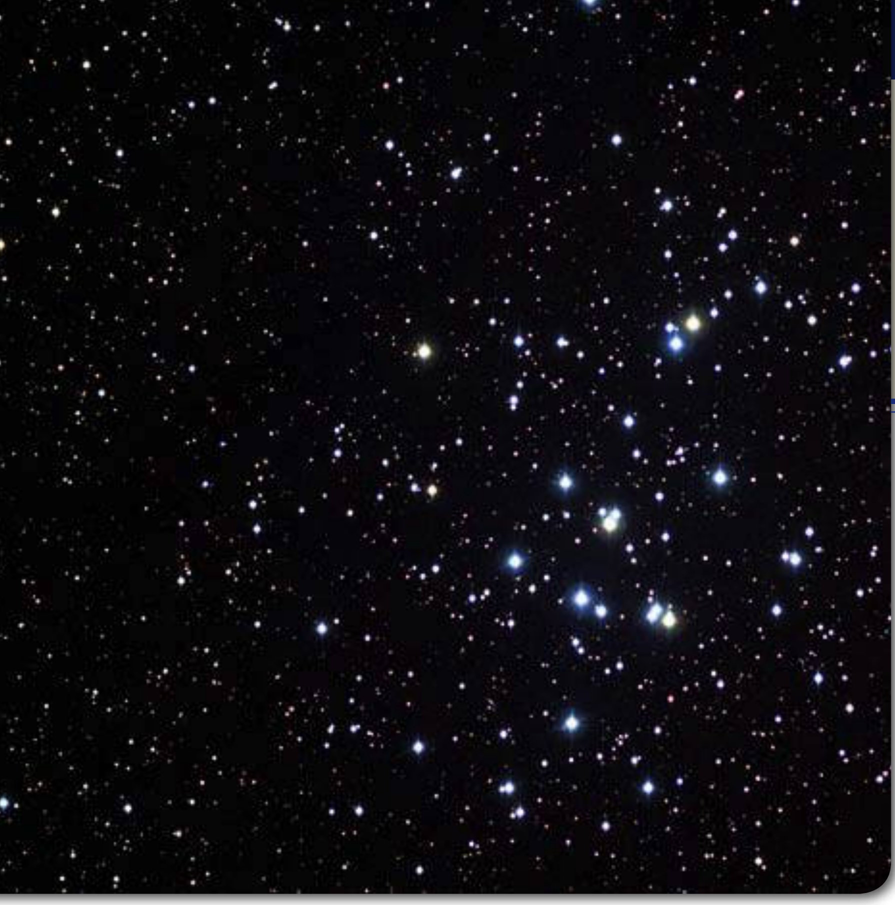
Also known as: NGC 2437
Right ascension: 7h42m
Declination: –14°49'
Magnitude: 6.0
Apparent size: 27'
Distance: 5,400 light-years
Visible: South of latitude 75° N.

IF YOU LIKE THIS OBJECT, be sure to observe:
The Tau CMa Cluster (NGC 2362) — page 8 • The Jewel Box (NGC 4755) — page 32 • The Double Cluster (NGC 869/884) — page 81

Best seen: **JANUARY 28**

7 The Beehive Cluster

Open cluster in Cancer



YOU WON'T HAVE ANY TROUBLE finding the Beehive Cluster (M44). Binoculars or a low-power eyepiece work best on this object. TOM BUSH/JOHN FOX/ADAM BLOCK/NOAO/AURA/NSF

The richness of the Beehive Cluster — a celestial object known since antiquity — makes up for the faintness of the constellation that contains it. M44 sits in Cancer the Crab, midway between Castor and Pollux, Gemini's two brightest stars, and Regulus, Leo the Lion's luminary.

If your sky isn't all that dark, use binoculars to locate the Beehive. With an apparent size of some 3 Full Moons side by side, M44 looks best through binoculars with magnifications between 10x and 16x.

Ancient mariners and others used the Beehive as a weather indicator. Greek poet Aratus (310–240 B.C.) called M44 the "Little Mist." When it was invisible in an otherwise clear sky, observers expected a storm within the day.

To the unaided eye, the Beehive appears nebulous, but the telescope's invention revealed its true nature. Galileo wrote in *Sidereus Nuncius* that he counted more than 40 stars in M44 as early as 1610. Astronomers today list upward of 350 stars belonging to the cluster.

M44's brightest star is Epsilon (ε) Cancri, which shines at magnitude 6.3. Some 80 of the cluster's stars are brighter than 10th magnitude.

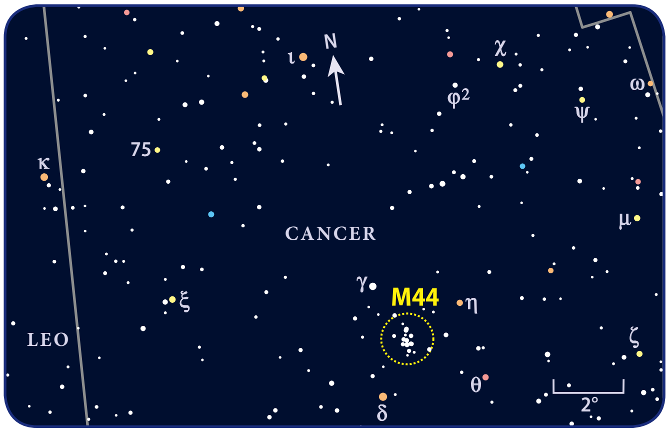
Astronomers classify M44 as an open star cluster. Open clusters are loose, irregular collections of hundreds to thousands of stars. They form in the nebula-rich areas of the Milky Way (and other, similar galaxies), especially along the spiral arms of these objects. Open clusters typically measure 10 light-years across.

Open clusters eventually dissolve; their life spans typically range from hundreds of millions to a billion years. Astronomers believe our Sun formed in such a cluster.

Open clusters dissolve mainly because of interactions between stars in the cluster. If the individual motions of two stars in an open cluster, for example, bring them close together, one or both stars may be thrown from the cluster by a gravitational slingshot effect.

Beehive Cluster statistics

Also known as: Praesepe, M44, and NGC 2632
Right ascension: 8h40m
Declination: 19°59'
Magnitude: 3.1
Apparent size: 95'
Distance: 577 light-years
Visible: North of latitude 70° S.



FIND M44 between Pollux (Beta [β] Geminorum) and Regulus (Alpha [α] Leonis). M44 lies 15° east-southeast of Pollux and 22° north-northwest of Regulus.

Look for these celestial targets nearby:

- **M67,** a magnitude 6.9 open cluster, lies 8.3° south-southeast.
- **M105,** a magnitude 9.5 elliptical galaxy, lies 31.5° east.
- **NGC 2683,** a magnitude 9.7 spiral galaxy, lies 14° north.
- **NGC 2775,** a magnitude 10.4 spiral galaxy, lies 14.5° south-southeast.

M67

ANTHONY AYIOMAMITIS

IF YOU LIKE THIS OBJECT, be sure to observe:
Ptolemy's Cluster (M7) — page 46 • The Double Cluster (NGC 869/884) — page 81 • M37 — page 95

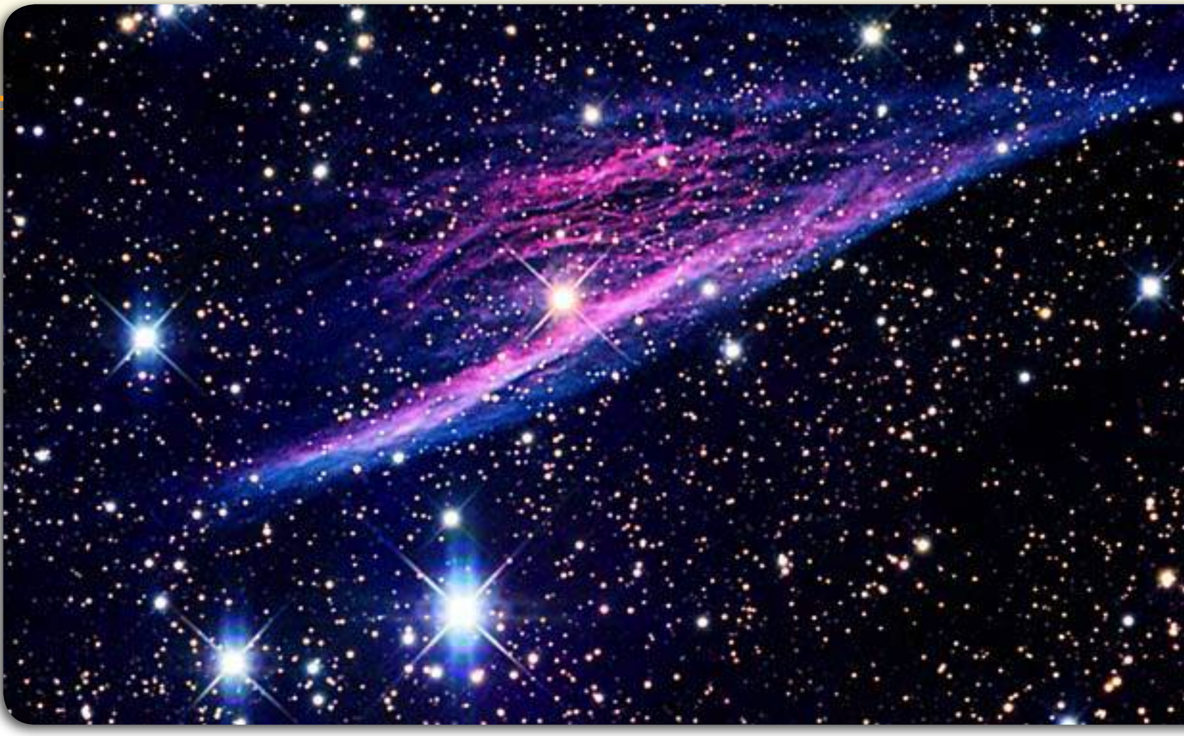
Best seen: **FEBRUARY 2**

8 The Pencil Nebula

Supernova remnant in Vela

Pencil Nebula statistics

Also known as: Herschel's Ray and NGC 2736
Right ascension: 9h00m
Declination: –45°57'
Magnitude: —
Apparent size: 20'
Distance: 800 light-years
Visible: South of latitude 44° N.



THE PENCIL NEBULA (NGC 2736) in Vela is a glowing gaseous region at the east-southeast end of the Vela Supernova Remnant. A nebula filter really helps bring out the detail in this object. DANIEL VERSCHATSE

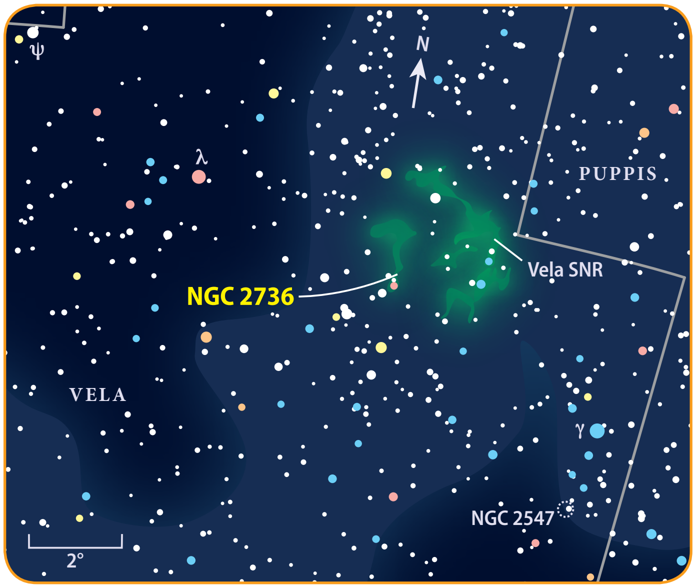
The Pencil Nebula region became luminous when a supernova's shock wave encountered dense interstellar material. The nebula contains large, wispy, filamentary structures and diffuse patches of gas.

The Pencil Nebula measures 0.75 light-year across, while the Vela supernova remnant (SNR) that contains it spans 114 light-years. The remnant lies 815 light-years away.

The supernova's shock wave heated the gas to millions of degrees. As the gas cools, it emits light. Some regions are still so hot that ionized oxygen atoms, which glow blue, dominate the emission. Other regions, made of hydrogen atoms, have cooled more and emit red light.

The best way to observe the Pencil Nebula is to use a 12-inch or larger telescope with a low-power eyepiece equipped with a nebula filter, such as an OIII. Either disengage your telescope's drive motor or set its slewing speed at "medium," and scan the area.

As you observe the Vela SNR, you'll see the double star DUN 70. Its blue and white components shine at magnitudes 5.2 and 6.8, respectively, and they lie 4.5" apart.



THE PENCIL NEBULA lies between magnitude 2.2 Lambda (λ) and magnitude 1.8 Gamma (γ) Velorum.

Look for these celestial targets nearby:

››› **NGC 2451,** a magnitude 2.8 open cluster, lies 16° west-northwest.

››› **NGC 2247,** a magnitude 5.8 open cluster, lies 14.5° west-northwest.

››› **NGC 2457,** a magnitude 4.7 open cluster, lies 9° west-southwest.

››› **The Omicron Velorum Cluster (IC 2391),** a magnitude 2.6 open cluster, lies 7.5° south-southwest.

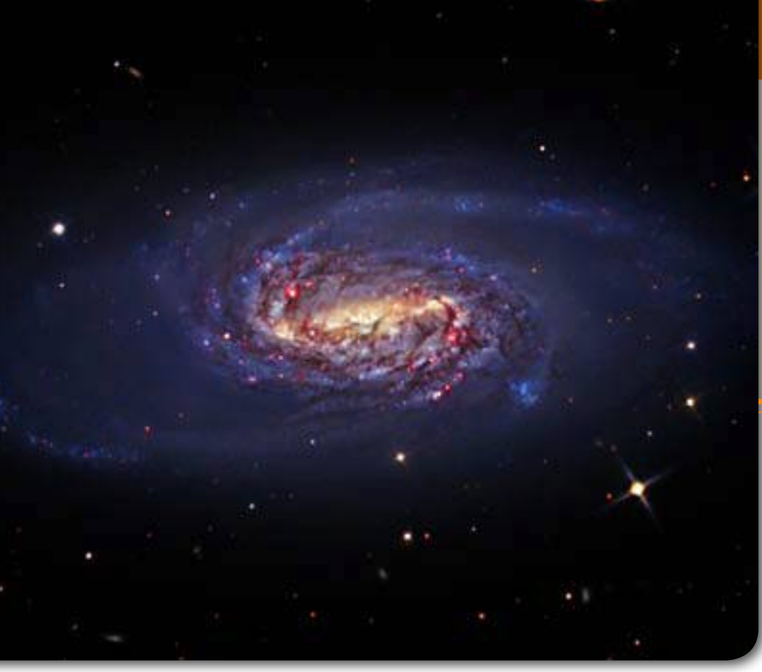
IF YOU LIKE THIS OBJECT, be sure to observe:

The Dumbbell Nebula (M27) — page 57 • The Veil Nebula (NGC 6992/5) — page 61 • The Crab Nebula (M1) — page 91

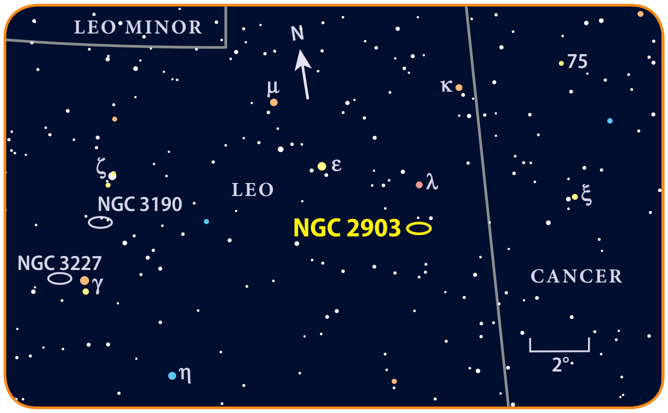
Best seen: **FEBRUARY 10**

9 NGC 2903

Barred spiral galaxy in Leo



SPIRAL GALAXY **NGC 2903 in Leo shines at an impressive magnitude 8.9, but it did not make Messier's catalog.** TONY AND DAPHNE HALLAS



NGC 2903 **lies just west of Leo's sickle-shaped asterism. Look 1.5° south of magnitude 4.3 Lambda (λ) Leonis.**

NGC 2903 statistics

Also known as: UGC 5079
Right ascension: 9h32m
Declination: 21°30'
Magnitude: 8.9
Apparent size: 13' by 7'
Distance: 20 million light-years
Visible: North of latitude 68° S.

Leo the Lion contains many fine galaxies, five of which (M65, M66, M95, M96, and M105) made Messier's list. Don't overlook NGC 2903, however, which shines brighter than any of Messier's galaxies except M66. Sir William Herschel discovered NGC 2903 in 1784 during one of his sky surveys.

Astronomers classify NGC 2903 as a "hotspot" galaxy, a term coined in the 1950s that describes a ring of infrared-luminous knots near a galaxy's core. In NGC 2903, the ring measures some 2,000 light-years in diameter. The knots, which account for approximately 10 percent of the galaxy's central mass, are hot star clusters only 6 to 9 million years old.

Although NGC 2903 is a bright galaxy, unfortunately you won't see much detail through a telescope with an aperture smaller than 10 inches. Through a 10-inch scope, look for a halo 4' by 2' that surrounds a bright, elongated core. Close examination at high magnification reveals the galaxy's central bar and the spiral arms, which don't shine much brighter than its halo. Through larger scopes, look for dust lanes and emission nebulae spread throughout NGC 2903's spiral arms.

A second deep-sky object — NGC 2905 — appears as a bright knot within NGC 2903. NGC 2905 is a star-forming region, to which Herschel assigned a second designation. It lies slightly more than 1' north-northeast of NGC 2903's core.

Look for these celestial targets nearby:

››› **NGC 3190,** a magnitude 11.1 spiral galaxy, lies 10.7° east.

››› **NGC 3227,** a magnitude 10.4 spiral galaxy, lies 12° east.

››› **NGC 3377,** a magnitude 10.2 elliptical galaxy, lies 19.5° east-southeast.

››› **Leo I,** a magnitude 11.2 elliptical galaxy, lies 12.6° southeast.

CHRIS SCHUR

IF YOU LIKE THIS OBJECT, be sure to observe:
NGC 2403 — page 10 • The Southern Whirlpool Galaxy (M83) — page 38 • The Pinwheel Galaxy (M33) — page 80

Best seen: **FEBRUARY 16**

10 Bode's Galaxy

Spiral galaxy in Ursa Major

In the northwest section of Ursa Major the Great Bear sits M81, one of the sky's brightest galaxies. German astronomer and celestial cartographer Johann Elert Bode (1747–1826) discovered this object, and nearby irregular galaxy M82, December 31, 1774. French astronomer Pierre Francois André Méchain (1744–1804) independently discovered both galaxies in August 1779 and reported them to Charles Messier, who added them to his list.

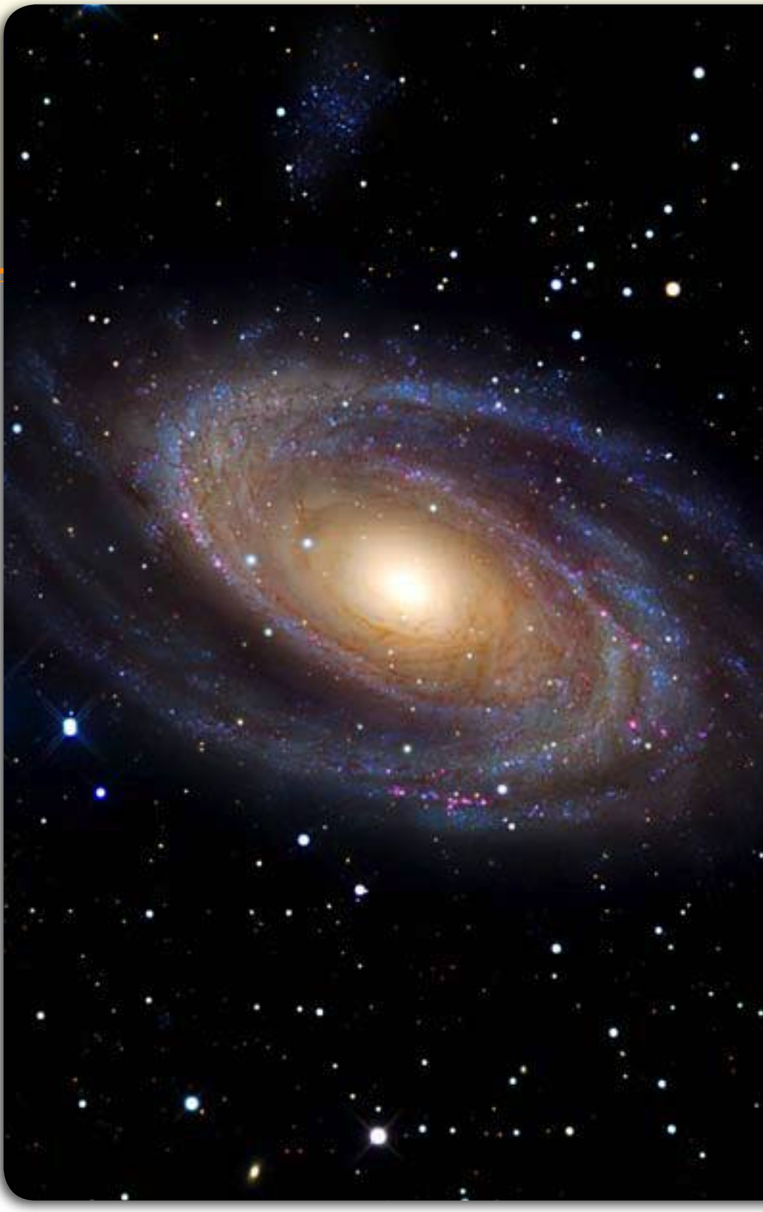
Bode's Galaxy glows brightly enough to show up through binoculars, but the larger the telescope you can point at it, the better. Through an 8-inch scope, you'll see a large, bright central region surrounding the much brighter core.

Through a 12-inch instrument, you'll detect how the spiral arms wind tightly around the core. The easternmost arm appears brighter. Unfortunately, you won't detect any dust lanes or star-forming regions through amateur scopes of any size.

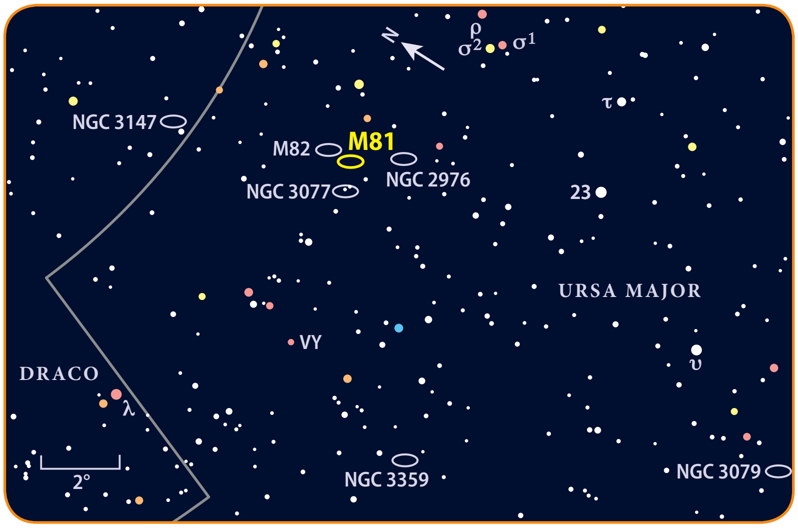
M81 is the brightest member of the M81 Group, one of the closest galactic groups to our own Local Group (see page 10). The M81 Group contains about a dozen galaxies and lies 12 million light-years away.

Bode's Galaxy statistics

Also known as: M81 and NGC 3031
Right ascension: 9h56m
Declination: 69°04'
Magnitude: 6.9
Apparent size: 21' by 10'
Distance: 12 million light-years
Visible: North of latitude 20° S.



BODE'S GALAXY (M81) lies in the northernmost reaches of Ursa Major. Use an eyepiece that provides a wide field of view to see both M81 and nearby M82. R. JAY GABANY



SPIRAL GALAXY M81 lies in a rich galaxy field about 10° northwest of the Big Dipper's bowl. M81 outshines all nearby galaxies.

Look for these celestial targets nearby:

››› **NGC 2476,** a magnitude 12.6 elliptical galaxy, lies 33° southwest.

››› **NGC 2768,** a magnitude 9.9 elliptical galaxy, lies 10.1° south-southwest.

››› **NGC 3077,** a magnitude 10.0 spiral galaxy, lies 0.8° east-southeast.

››› **IC 2574,** a magnitude 10.2 spiral galaxy, lies 3° east.

IF YOU LIKE THIS OBJECT, be sure to observe:

The Silver Coin Galaxy (NGC 253) — page 76 • The Southern Pinwheel Galaxy (NGC 300) — page 78 • Cetus A (M77) — page 84

THE CIGAR GALAXY (M82) is a starburst galaxy in Ursa Major. A high rate of star formation occurs in such objects. R. JAY GABANY

Best seen: **FEBRUARY 16**

11 The Cigar Galaxy

Starburst galaxy in Ursa Major

Cigar Galaxy statistics

Also known as: M82 and NGC 3034
Right ascension: 9h56m
Declination: 69°41'
Magnitude: 8.4
Apparent size: 9' by 4'
Distance: 12 million light-years
Visible: North of latitude 20° S.

Point your telescope 0.6° due south of Bode’s Galaxy (page 15), and you might think you’re seeing a galaxy explode. Not exactly. What you’ve found is M82, the classic example of a starburst galaxy. Its core comprises a complex of star-forming regions that each dwarf the Orion Nebula (page 93).

M82’s appearance is due to a close interaction with neighboring galaxy M81 between 500 million and 600 million years ago. Astronomers studying Hubble Space Telescope images have discovered more than 100 globular clusters around M82.

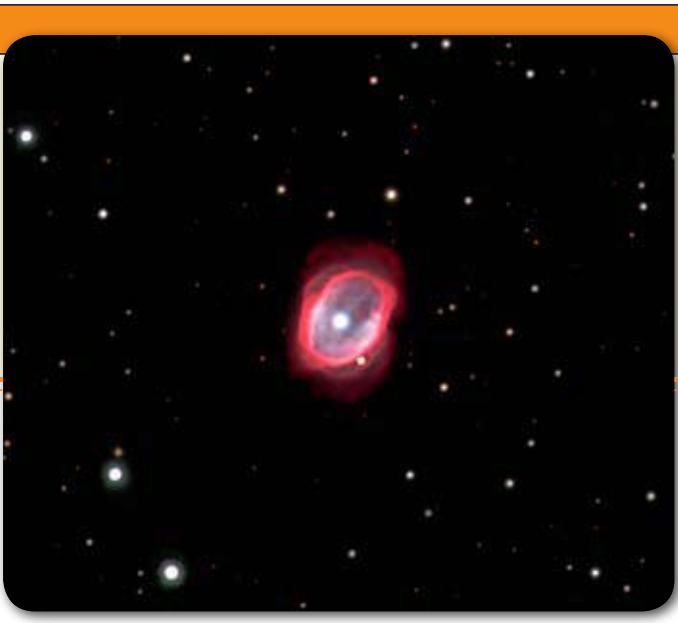
Best seen: **FEBRUARY 19**

12 The Eight-burst Nebula

Planetary nebula in Vela

Eight-burst Nebula statistics

Also known as: NGC 3132 and Caldwell 74
Right ascension: 10h07m
Declination: –40°26'
Magnitude: 9.9
Apparent size: 1.4' by 0.9'
Distance: 2,000 light-years
Visible: South of latitude 49° N.



THE EIGHT-BURST NEBULA (NGC 3132) in Vela is a planetary nebula that shows lots of detail through a 12-inch or larger telescope. Look for the overlapping ovals at different angles. DANIEL VERSCHATSE

Ten thousand years ago, a Sun-like star in the southern constellation Vela the Sails reached the end of its life and expelled its outer layers into space. What remained of the star’s core shrank to the size of Earth, its surface heated up to 180,000° F (100,000° C), and it began emitting ultraviolet radiation.

Scientists call such stellar corpses white dwarfs. The expanding shell of gas illuminated by the white dwarf’s radiation formed a planetary nebula. Astronomers think our Sun will undergo a similar fate after it exhausts its core supply of hydrogen. No need to panic just yet, however. The Sun has enough hydrogen to keep going for 5 billion more years.

When you observe NGC 3132, you’ll find an object

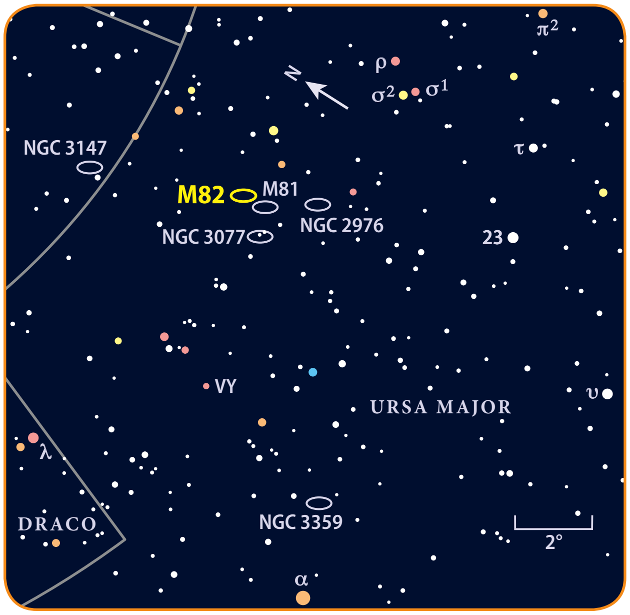
IF YOU LIKE THIS OBJECT, be sure to observe:

The Silver Needle Galaxy (NGC 4244) — page 21 • The Needle Galaxy (NGC 4565) — page 26 • NGC 6744 — page 53

Unlike the globulars in our galaxy, which are as old as the Milky Way itself, M82's globulars are young. They probably formed during the interaction with M81.

M82 appears 4 times as long as wide, and its long axis orients east-southeast to west-northwest. The galaxy's brightest part lies east of center. Farther east, a dark lane cuts diagonally across M82's minor axis.

M82 has a high surface brightness. To illustrate what this means, compare M82 to M81 in an eyepiece that just frames them both. Although M82 shines a magnitude and a half fainter than M81, it appears about as bright. Use high magnification to reveal its details, even on less-than-perfect nights. This technique doesn't work on low-surface-brightness galaxies.



THE CIGAR GALAXY (M82) lies in the northwestern part of Ursa Major, only 3° from the Draco border.

Look for these celestial targets nearby:

ALEX AND MIKE BECK/ADAM BLOCK/NOAO/AURA/NSF

››› **NGC 2655,** a magnitude 10.1 spiral galaxy, lies 9.5° north-northwest.

››› **NGC 3147,** a magnitude 10.6 spiral galaxy, lies 4° north-northeast.

››› **NGC 3735,** a magnitude 11.9 spiral galaxy, lies 8.5° east-northeast.

››› **NGC 4589,** a magnitude 10.7 elliptical galaxy, lies 13° northeast.

Look for these celestial targets nearby:

DANIEL VERSCHATSE

››› **NGC 2818,** a magnitude 11.6 planetary nebula, lies 10.6° north-northwest.

››› **NGC 2997,** a magnitude 9.4 spiral galaxy, lies 10.2° north-northwest.

››› **NGC 3175,** a magnitude 11.3 spiral galaxy, lies 11.7° north.

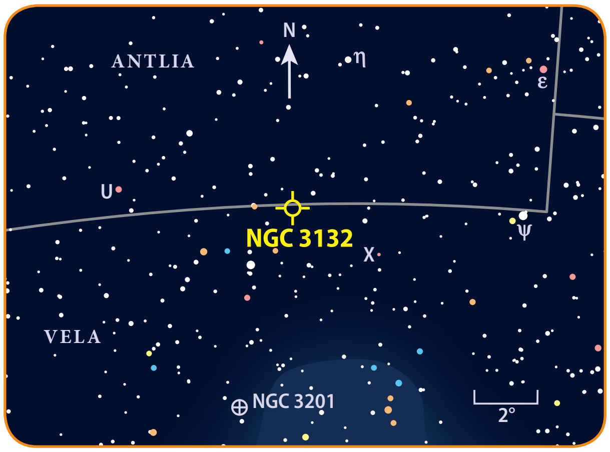
››› **NGC 3201,** a magnitude 6.9 globular cluster, lies 6.2° south-southeast.

about the same size and dimensions as the Ring Nebula (page 52). NGC 3132's structure, however, is more complex.

Several ovals appear superimposed and tilted at different angles. Use high magnification in a 12-inch or larger telescope to pick them out. The nebula's outer boundary also looks more irregular, and the region around the central star contains more material than in the Ring Nebula's case.

Speaking of the central star, there's more to it than meets the eye. The 10th-magnitude star at NGC 3132's center is not associated with the nebula although it contributes to this region's brightness. Rather, a 16th-magnitude star — invisible through amateur telescopes — is the Eight-burst Nebula's true central star. It lies 2" from its brighter companion.

NGC 3132 has a high surface brightness, so it responds well to high magnifications (in excess of 250x). A diffuse, irregularly bright inner shell surrounds the imposter central star. The brightest gaseous region forms the nebula's border.



NGC 3132 lies 7° east of magnitude 3.6 Psi (ψ) Velorum about 0.1° south of Vela's border with Antlia.

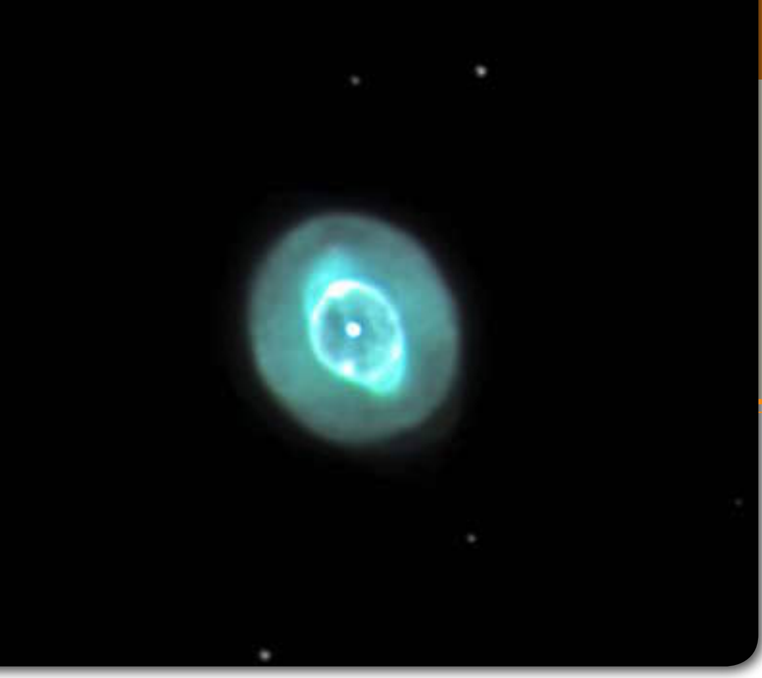
IF YOU LIKE THIS OBJECT, be sure to observe:

The Ghost of Jupiter (NGC 3242) — page 18 • The Cat's Eye Nebula (NGC 6543) — page 48 • The Ring Nebula (M57) — page 52

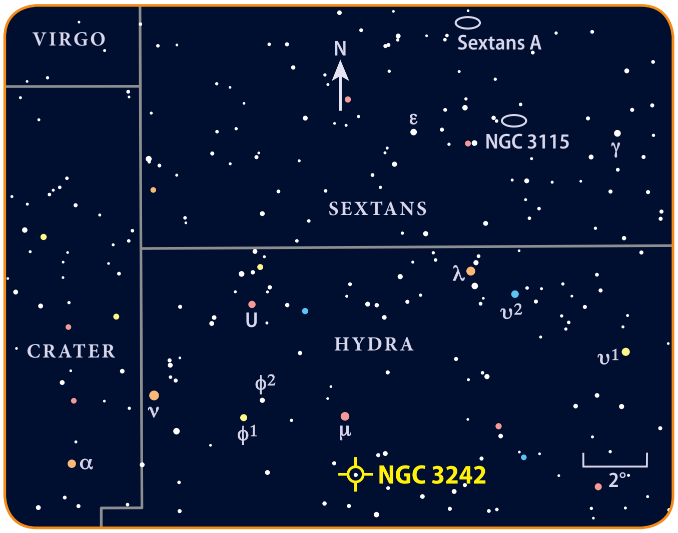
Best seen: **FEBRUARY 24**

13 The Ghost of Jupiter

Planetary nebula in Hydra

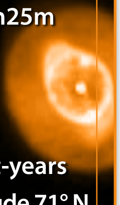


THE GHOST OF JUPITER (NGC 3242), 2° south of Mu (μ) Hydrae, ranks as one of the sky's brightest planetary nebulae. Even through a small scope, you'll see its blue color. ADAM BLOCK/NOAO/AURA/NSF



NGC 3242 lies in a rather barren region of sky in the central part of Hydra the Water Snake.

Ghost of Jupiter statistics



Also known as: The Eye Nebula, NGC 3242, and Caldwell 59

Right ascension: 10h25m

Declination: –18°38'

Magnitude: 7.7

Apparent size: 21'

Distance: 2,500 light-years

Visible: South of latitude 71° N.

When northern winter nights turn to spring, Hydra the Water Snake — the sky's largest constellation — wends its way across the sky's midsection. In this star pattern's east-central section, you'll find the Ghost of Jupiter, the spring sky's showpiece planetary nebula.

Some 45° separate the Ghost from Hydra's other wonder, the Southern Whirlpool Galaxy (page 38). Illustrating just how much of the sky Hydra spans, the angular separation between these two objects represents less than half of the constellation's length.

This object received its common name, "Ghost of Jupiter," from its planet-like appearance when seen through small telescopes. Based on its color and brightness, it mostly resembles Uranus or Neptune. Sir William Herschel discovered NGC 3242 in 1785.

At low magnification through a 6-inch telescope, you'll see the Ghost's softly glowing, pale, blue-green disk. Through larger scopes, and at powers in excess of 200x, the interior appears oval, like an eye or a football. The inner 10" appears hollow, except for the dim central star. A faint spherical shell 40" across encloses the "eye." Your best bet for observing the outer shell is to use a 12-inch or larger telescope, an eyepiece that provides about 100x, and a nebula filter.

Much of the Ghost's blue-green color comes from oxygen atoms absorbing ultraviolet radiation from the central star and reradiating it as visible light. Because this emission is strong, an OIII filter works best for observing NGC 3242.

"OIII" stands for "doubly ionized oxygen." Chemists use "III" to represent double ionization because they label neutral oxygen OI. Nebula filters such as OIII screw directly into the threaded barrels of 1¼" or 2" eyepieces. Be careful when screwing them in on cold nights if you're wearing gloves.

OIII filters cut light pollution's effects and enhance views of planetary nebulae from dark sites. 100

Look for these celestial targets nearby:

››› **M65,** a magnitude 11.4 spiral galaxy, lies 17° east-northeast.

››› **M66,** a magnitude 9.1 elliptical galaxy, lies 12° north-northwest.

››› **M95,** a magnitude 10.8 spiral galaxy, lies10° east-southeast.

››› **M96,** a magnitude 9.8 spiral galaxy, lies 9° south-southwest.

M95

R. JAY GABANY

IF YOU LIKE THIS OBJECT, be sure to observe:

The Eskimo Nebula (NGC 2392) — page 9 • The Owl Nebula (M97) — page 20 • The Helix Nebula (NGC 7293) — page 68

Best seen: **FEBRUARY 28**

14 The Eta Carinae Nebula

Emission nebula in Carina

Eta Carinae Nebula statistics

Also known as: NGC 3372 and Caldwell 92

Right ascension: 10h44m

Declination: –59°52'

Magnitude: 1.0

Apparent size: 120'

Distance: 7,500 light-years

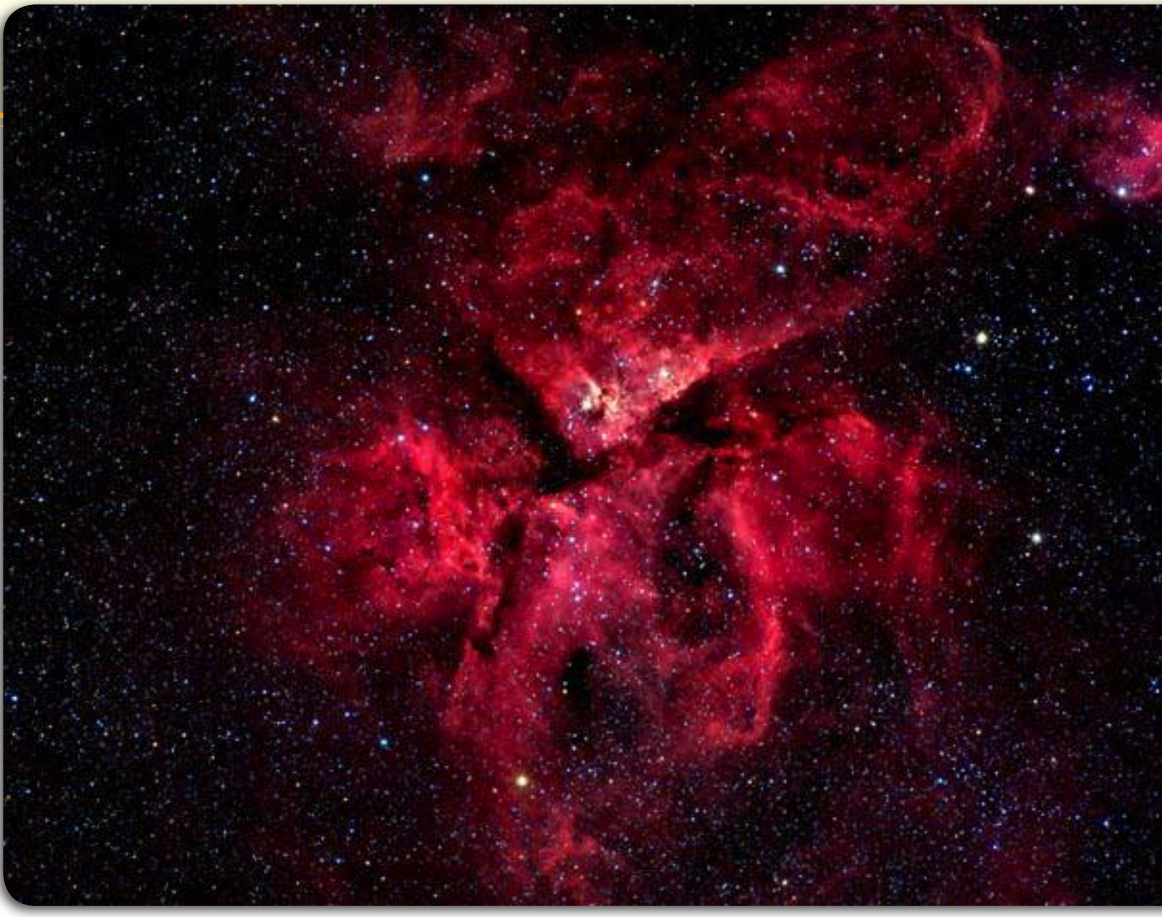
Visible: South of latitude 30° N.

Imagine a gas cloud nearly a light-year long expanding at 1.5 million mph (2.3 million km/h). Within the cloud sits a supermassive star radiating 5 million times the Sun's energy. This scenario describes the Eta Carinae Nebula and its 6th-magnitude central star, Eta Carinae.

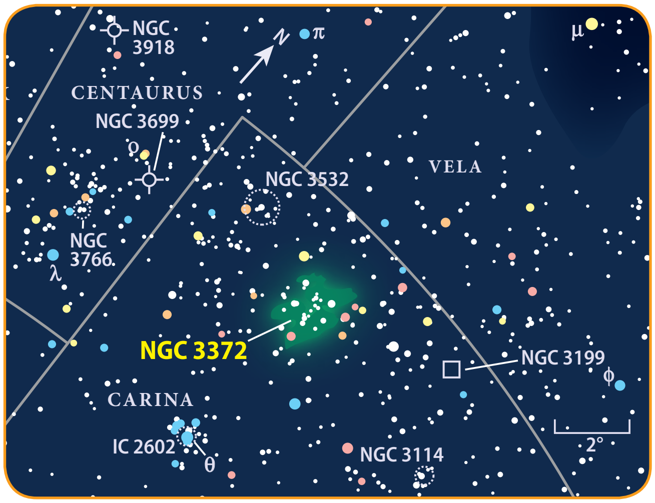
Eta Carinae underwent a giant outburst about 150 years ago, when it became the second-brightest star in the sky. Although it released as much visible light as a supernova explosion would, the star survived and produced a nebula with two polar lobes and a large, thin disk. Astronomers call the bi-lobed nebula the Homunculus, derived from the Latin for "little man."

Easily visible to the naked eye as the brightest spot in the southern Milky Way, NGC 3372 looks great through any size telescope. At magnifications below 50x, the most prominent detail is a dark, V-shaped rift slicing through the nebula's center. Move to 100x to see a scalloped edge against a bright background.

Look toward NGC 3372's center for the Keyhole Nebula, a dark cloud with overlapping nebulosity. At 200x, you'll see a yellowish region, which some amateurs have dubbed the Fried Egg. If the seeing is good, you may detect thin spokes of nebulosity that seem to emanate from the central star. 100



THE ETA CARINAE NEBULA (NGC 3372) is the southern sky's equivalent of the Orion Nebula (page 92). You'll want to spend lots of time exploring this wondrous object. GERALD RHEMANN AND MICHAEL JÄGER



THE ETA CARINAE NEBULA lies in a rich Milky Way star field. Crux the Southern Cross lies 13° east. Through binoculars, contrast the dark Coalsack (page 31) with the Eta Carinae Nebula.

Look for these celestial targets nearby:

››› **NGC 3114,** a magnitude 4.2 open cluster, lies 5.1° west-southwest.

››› **NGC 3199,** an emission nebula, lies 4° west-northwest.

››› **NGC 3532,** a magnitude 3.0 open cluster, lies 3° east-northeast.

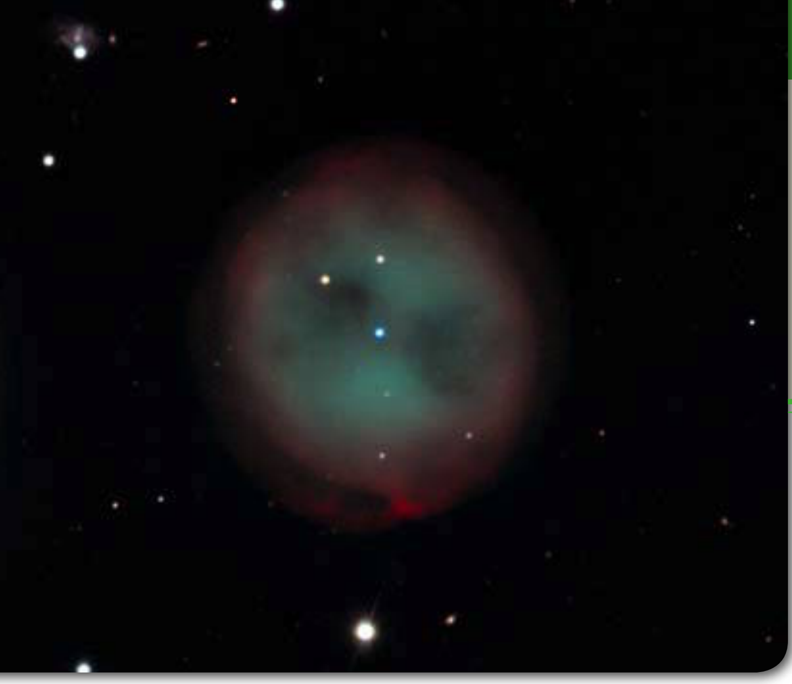
››› **THE SOUTHERN PLEIADES** (IC 2602), a magnitude 1.6 open cluster, lies 4.5° south.

IF YOU LIKE THIS OBJECT, be sure to observe:

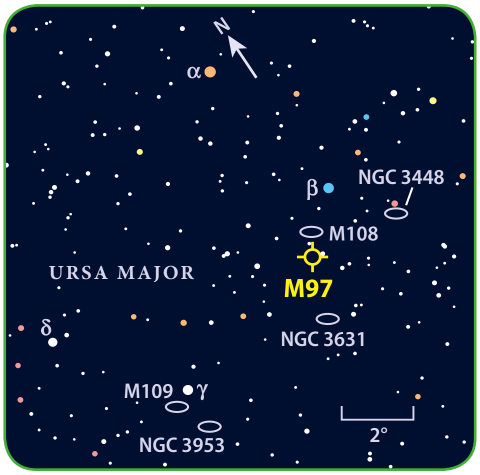
The Lagoon Nebula (M8) — page 49 • The North America Nebula (NGC 7000) — page 62 • The Orion Nebula (M42) — page 92

15 The Owl Nebula

Planetary nebula in Ursa Major



THE OWL NEBULA (M97) in Ursa Major resembles the face of the bird after which it's named. GARY WHITE/VERLENNE MONROE/ADAM BLOCK/NOAO/AURA/NSF



THE OWL NEBULA (M97) is an easy star-hop from magnitude 2.3 Merak (Beta [β] Ursae Majoris). Just move 2.3° southeast. If your eyepiece/telescope combination gives a 1° field of view, try to capture both M97 and spiral galaxy M108 together. It lies 0.8° northwest of the Owl Nebula.

Just below the Big Dipper's bowl sits the Owl Nebula — an object that challenges observers with small telescopes and delights those with large ones. Of the 109 objects in Charles Messier's catalog, only four glow more faintly than M97.

Pierre Méchain discovered this object February 16, 1781, but it was William Parsons, third earl of Rosse (1800–1867) who first called it the Owl Nebula. In March 1848, he described, "Two stars considerably apart in the central region: dark penumbra around each spiral arrangement." Rosse later saw only one star and doubted the spiral form.

M97's orientation may be responsible for the owl's "eyes." Some astronomers have speculated this nebula is a torus (a sphere with a hollow cylinder from pole to pole) tilted to our line of sight so the cylinder's ends, where material is thinnest, form the eyes.

M97 formed when a Sun-like star blew its outer layers into space while the core collapsed into a white dwarf. A 2003 study by researchers from the University of Illinois, the Instituto de Astrofisica de Canarias in Spain, and Williams College in Massachusetts concluded M97's structure developed in stages.

The shape formed after fusion stopped and the star ejected its shell. The hotter star produced a stellar wind, which cleared out the nebula's central region. The wind intensified, propelling more gas outward to form an inner shell and the two cavities.

Because the Owl Nebula has a low surface brightness, use an OIII filter and a magnification of about 100x to see it best. If you view through a 10-inch or larger telescope, look for the size discrepancy between the eyes. If your sky is dark, you may see the disk's outer 10 percent as a faint ring.

Owl Nebula statistics

Also known as: M97 and NGC 3587
Right ascension: 11h15m
Declination: 55°01'
Magnitude: 9.9
Apparent size: 3.4'
Distance: 2,600 light-years
Visible: North of latitude 35° S.

M109

RAY J. GaBANY

Look for these celestial targets nearby:

- ››› **M40,** a magnitude 8.4 double star, lies 9.8° east-northeast.
- ››› **M108,** a magnitude 9.9 spiral galaxy, lies 0.8° northwest.
- ››› **M109,** a magnitude 9.8 spiral galaxy, lies 6.5° east.
- ››› **NGC 3631,** a magnitude 10.1 spiral galaxy, lies 2° south-southeast.

IF YOU LIKE THIS OBJECT, be sure to observe:
The Dumbbell Nebula (M27) — page 57 • The Saturn Nebula (NGC 7009) — page 64 • The Bow-Tie Nebula (NGC 40) — page 72

Best seen: **MARCH 25**

16 The Silver Needle Galaxy

Spiral galaxy in Canes Venatici

Silver Needle Galaxy statistics

Also known as: NGC 4244 and Caldwell 26

Right ascension: 12h18m

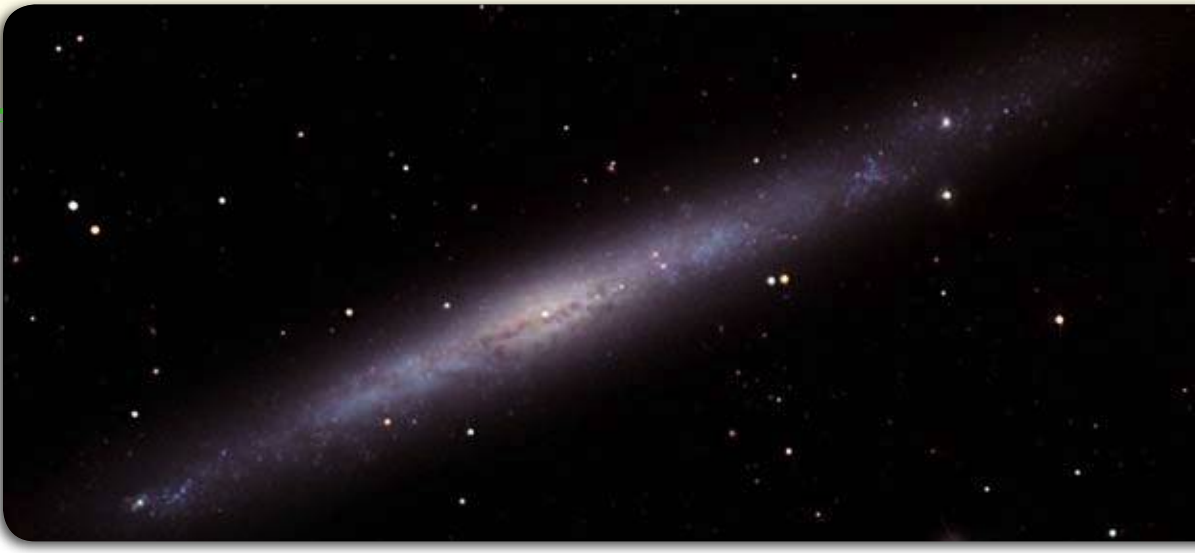
Declination: 37°49'

Magnitude: 10.2

Apparent size: 16'

Distance: 15 million light-years

Visible: North of latitude 52° S.



THE SILVER NEEDLE GALAXY (NGC 4244) in Canes Venatici doesn't show much detail, but its measurements are impressive: This edge-on spiral is 7 times longer than it is wide. JOE NAUGHTON/STEVE STAFFORD/ADAM BLOCK/NOAO/AURA/NSF

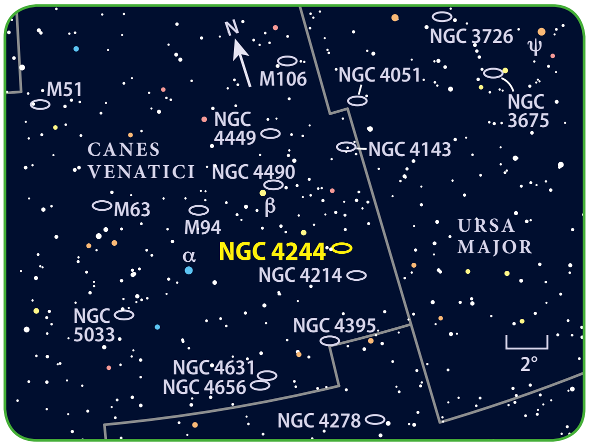
To observers, spring in the Northern Hemisphere means it's time to hunt galaxies. And while the giant constellations Virgo, Ursa Major, and Leo hold hundreds of worthy targets, don't overlook Canes Venatici. Although its stars are faint (Canes Venatici ranks 84th in brightness out of the 88 constellations), it contains many bright galaxies.

Four of these made both Messier's list and our 100 sky wonders — M51 (page 37), M63 (page 34), M94 (page 30), and M106 (page 22). And although the Silver Needle Galaxy doesn't stand out like these luminaries, it has a lot to offer observers.

NGC 4244's disk appears almost edge-on, tilting only 5° to our line of sight. Through the eyepiece, this galaxy has a relatively even illumination — the core appears only slightly brighter than the rest. The Silver Needle Galaxy also has high surface brightness, so crank up the power.

Astroimages reveal periodic clumping of stellar material along its disk. Judging by the clumps' spacing, this galaxy probably has loosely wound spiral arms. What sets the Silver Needle Galaxy apart, however, is its length-to-width ratio and its appearance through small scopes.

Once you view this object through a 4-inch or smaller telescope from a dark site, you'll understand why its name contains the word "needle." Through larger scopes, the needle-like quality disappears. To the northeast, the galaxy fades gradually into a broad haze. On the opposite side of the core, the surface appears more mottled and irregular. 100



THE SILVER NEEDLE GALAXY (NGC 4244) lies in a crowded field. Start your star-hop at magnitude 4.2 Chara (Beta [β] Canum Venaticorum). Move 2.8° south-southeast to 5th-magnitude 6 CVn, then head another 2° south-west.

JOHN AND CHRISTIE CONNORS/ADAM BLOCK/NOAO/AURA/NSF

Look for these celestial targets nearby:

- ››› **NGC 4111,** a magnitude 10.8 spiral galaxy, lies 5.6° north-northwest.
- ››› **NGC 4143,** a magnitude 10.8 spiral galaxy, lies 5° north-northwest.
- ››› **NGC 4214,** a magnitude 9.6 irregular galaxy, lies 1.5° south-southwest.
- ››› **NGC 4449,** a magnitude 9.4 irregular galaxy, lies 6.6° north-northeast.

IF YOU LIKE THIS OBJECT, be sure to observe:

NGC 2403 — page 10 • The Needle Galaxy (NGC 4565) — page 26 • NGC 891 — page 82

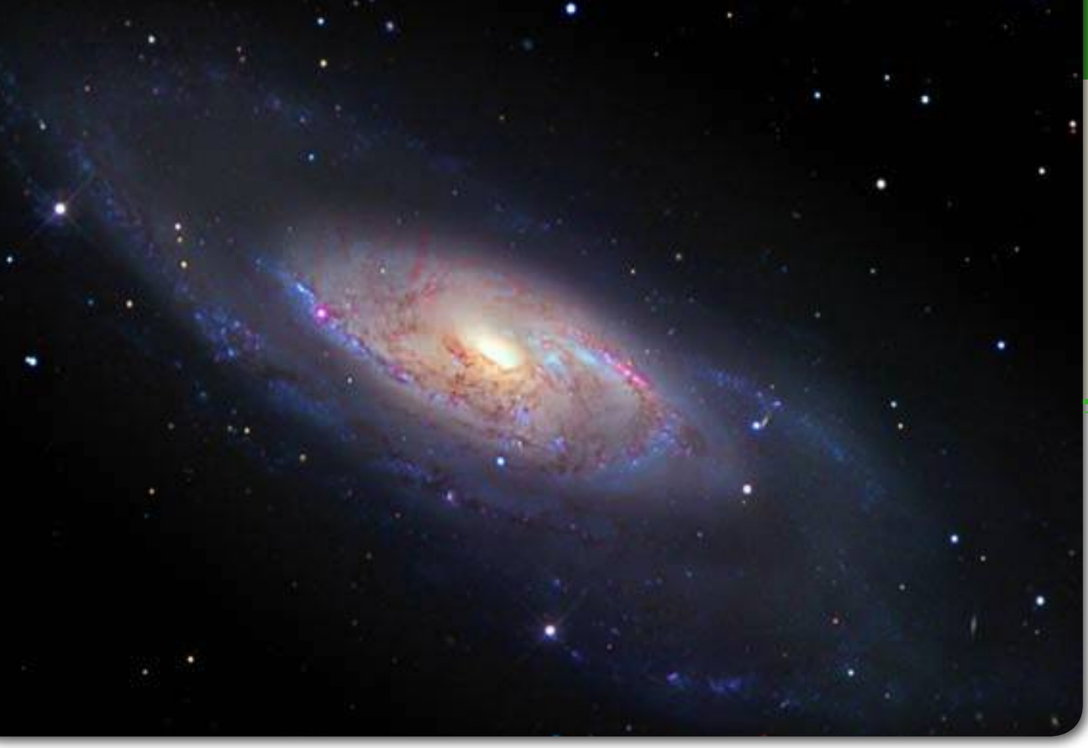
Best seen: **MARCH 26**

17 M106

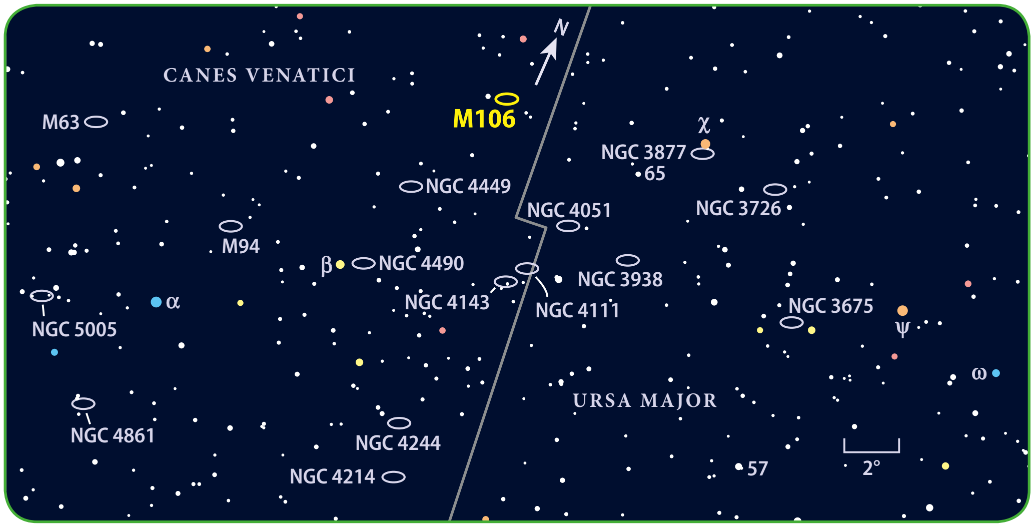
Spiral galaxy in Canes Venatici

M106 statistics

Also known as: NGC 4258
Right ascension: 12h19m
Declination: 47°18'
Magnitude: 8.3
Apparent size: 19' by 8'
Distance: 25 million light-years
Visible: North of latitude 42° S.



SPIRAL GALAXY M106 shines brightly in Canes Venatici the Hunting Dogs. Look for its compact spiral arms the next time you're at a dark site. RAY J. GABANY



FIND M106 within Canes Venatici's rich galaxy field 5.5° east of magnitude 3.7 Chi (χ) Ursae Majoris.

Look for these celestial targets nearby:

››› **NGC 3726,** a magnitude 10.2 spiral galaxy, lies 7.7° west.

››› **NGC 3877,** a magnitude 11.2 spiral galaxy, lies 5.5° south.

››› **NGC 3953,** a magnitude 9.8 spiral galaxy, lies 6.4° northwest.

››› **NGC 4051,** a magnitude 10.0 spiral galaxy, lies 3.9° southwest.

TOM AND GAIL HAYNES/ADAM BLOCK/NOAO/AURA/NSF

One of the best and brightest galaxies on this or any other list (including Messier's) also ranks as one of the least observed. It may be that because M106 falls near the end of Messier's list, observers think it's not a worthy target. Perhaps because it doesn't have a catchy name like the Sombrero Galaxy (M104), it seems less appealing. Nothing could be further from the truth.

M106's equatorial plane tilts to our line of sight, as does that of the Andromeda Galaxy, so many features resemble those in that object. This orientation explains why M106's dust lanes appear so prominent. The arms end in bright blue knots — young clusters dominated by massive stars.

M106 lies in the northwest corner of Canes Venatici, and it makes a triangle with Gamma (γ) and Chi (χ) Ursae Majoris. Look for a bright core surrounded by an oval haze. Next to the nucleus is a stretched-out inner disk a third of the galaxy's size.

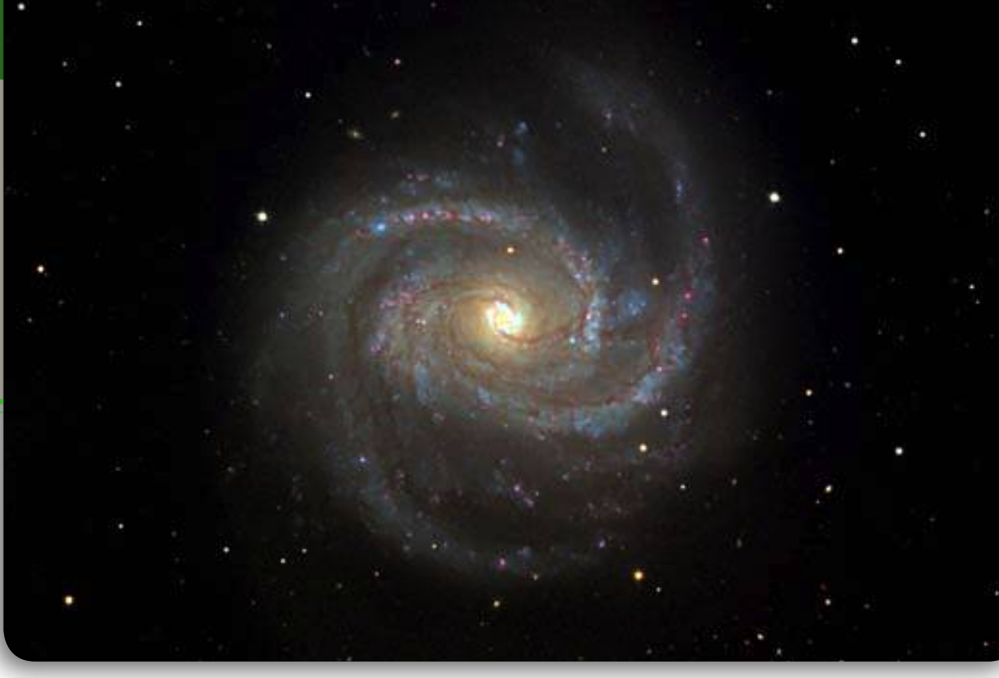
Through a 10-inch or larger telescope, you'll begin to see the mottled texture and spiral structure. The strikingly linear northern arm appears more pronounced, while the southern arm looks more diffuse. Be patient when observing the latter, and wait for moments of good seeing to help you pull out detail. 100

IF YOU LIKE THIS OBJECT, be sure to observe:
The Sombrero Galaxy (M104) — page 27 • **The Whale Galaxy (NGC 4631)** — page 29 • **NGC 6744** — page 53

Best seen: **MARCH 27**

18 M100

Spiral galaxy in Coma Berenices



SPIRAL GALAXY M100 in Coma Berenices lies in a rich field. Through a 12-inch telescope, you'll see hundreds of galaxies near M100. CURT AND SALLY KING/ADAM BLOCK/NOAO/AURA/NSF

In spring, the Milky Way encircles us along the horizon, turning the rest of the sky into a large, clear window for viewing distant galaxies. The north galactic pole, that point in our sky farthest from the plane of our galaxy, resides in Coma Berenices. Despite being a mid-sized constellation, it contains no fewer than eight Messier objects — including M100 — and dozens of bright, nearby galaxies of the Coma-Virgo galaxy cluster.

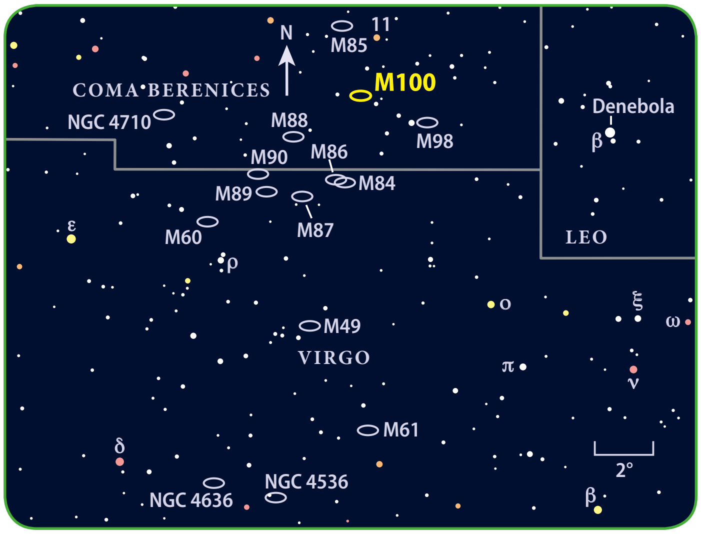
The Coma-Virgo cluster, sometimes shortened to "the Virgo cluster," lies approximately 60 million light-years away. Astronomers estimate between 1,500 and 2,000 galaxies populate this cluster, which forms the heart of the Local Supercluster.

The Local Group, of which our Milky Way is part, is another collection of galaxies within the Local Supercluster. The Virgo cluster's mass measures some 1.2 quadrillion (1.2 x 10^{15}) suns, and it spans more than 14 million light-years.

Because of the Virgo cluster's tremendous mass, it has slowed the velocities of all the galaxies around it. The result of this slowdown is a matter flow toward the cluster (called the Virgo-centric flow), which will continue to increase its size and mass.

Pierre Méchain discovered M100 March 15, 1781. It ranks as one of the brightest galaxies in the Coma-Virgo cluster, and it is a great target for amateur telescopes. Through an 8-inch scope at low to medium power, look for a haze about 4' long. You won't see this galaxy's spiral arms until you crank the magnification past 200x, and then only on the best nights.

The arms appear as brighter regions just to the east and west of the nucleus. Through a 12-inch telescope, you'll trace the spiral structure twice as far from the core. Two faint dwarf galaxies lie to the north and east. Magnitude 13.9 NGC 4322, to the north, appears to be M100's true companion, while magnitude 13.3 NGC 4328 lies in the foreground to the east.



M100 sits within one of the sky's brightest galaxy fields. To find it, start at 11 Comae Berenices, and look 2° south-southeast of that magnitude 4.7 star. No bright galaxy lies within 1° of M100.

M100 statistics

Also known as: NGC 4321
Right ascension: 12h23m
Declination: 15°49'
Magnitude: 9.3
Apparent size: 7'
Distance: 60 million light-years
Visible: North of latitude 74° S.

CHRIS SCHUR

Look for these celestial targets nearby:

- **M85,** a magnitude 9.1 spiral galaxy, lies 2.4° north-northeast.
- **M91,** a magnitude 10.1 spiral galaxy, lies 3.3° east-southeast.
- **M98,** a magnitude 10.1 spiral galaxy, lies 2.4° west-southwest.
- **M99,** a magnitude 9.7 spiral galaxy, lies 1.7° southwest.

IF YOU LIKE THIS OBJECT, be sure to observe:
The Whirlpool Galaxy (M51) — page 37 • NGC 6744 — page 53 • The Andromeda Galaxy (M31) — page 75

Best seen: **MARCH 27**

19 The Coma Berenices Cluster

Open cluster in Coma Berenices

THE COMA BERENICES CLUSTER (Melotte 111) is a large group of naked-eye stars in the northwest corner of Coma Berenices. Use binoculars for an even better view. JOHN CHUMACK

Coma Berenices is a poorly defined constellation containing only three stars brighter than magnitude 4.5. In this star group's northwest corner, you'll find yellow Gamma (γ) Comae Berenices. Gamma sits 170 light-years away. It rests in front of the Coma Berenices Cluster, which lies about 100 light-years farther from us.

This loose open cluster also carries the designation Melotte 111. British astronomer Philibert Jacques Melotte (1880–1961) placed it in *A catalog of star clusters shown on the Franklin-Adams chart plates*, which appeared in the *Memoirs of the Royal Astronomical Society*, volume 60, published in 1915. Still, it wasn't until 1938 that astronomers recognized the Coma Berenices Cluster as a true star cluster.

Melotte 111 contains some 40 stars between magnitudes 5 and 10.

Coma cluster statistics

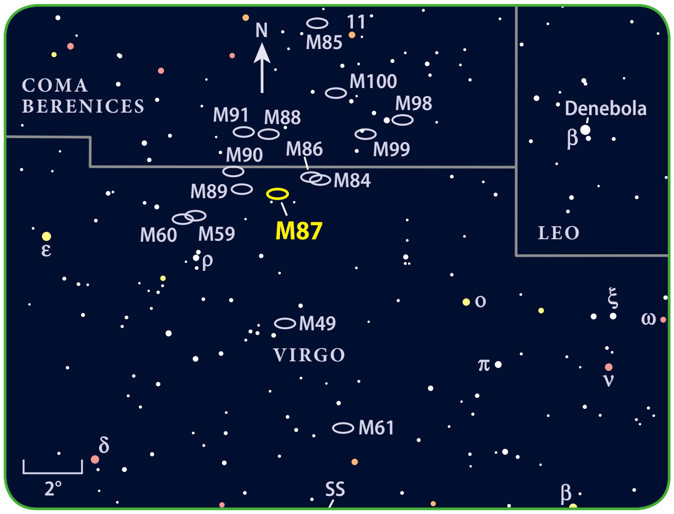
Also known as: Melotte 111
Right ascension: 12h25m
Declination: 26°
Magnitude: 1.8
Apparent size: 275'
Distance: 288 light-years
Visible: North of latitude 64° S.

Best seen: **MARCH 29**

20 Virgo A

Elliptical galaxy in Virgo

VIRGO A (M87) is one of the sky's most massive galaxies. Astronomers classify M87 as a giant elliptical galaxy. ADAM BLOCK/NOAO/AURA/NSF

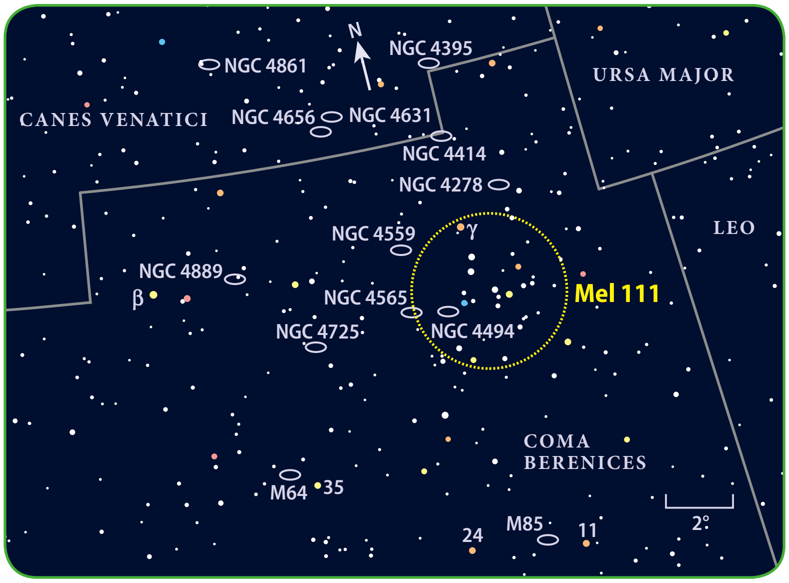


M87 is easy to identify as the brightest elliptical galaxy in the region known as Markarian's Chain (page 28).

The great elliptical galaxy M87 isn't just the biggest galaxy in the Virgo cluster, it's one of the largest and most luminous in the universe. M87's diameter — 120,000 light-years — exceeds that of our Milky Way by 20 percent. But because M87 is round and our Milky Way is flat, M87's volume is much greater. Astronomers estimate M87 contains 3 trillion solar-masses.

M87 is also bright. With an absolute magnitude of –22, M87 would shine at 2 percent of the Sun's brilliance from 32.6 light-years away. At that distance (the standard distance

IF YOU LIKE THIS OBJECT, be sure to observe:
The Tau CMa Cluster (NGC 2362) — page 8 • The Jewel Box (NGC 4755) — page 32 • The Double Cluster (NGC 869/884) — page 81



MELOTTE 111 consists of a loose, relatively large group of 5th-, 6th-, and 7th-magnitude stars. Several faint galaxies lie tucked among its bright stars.

About a dozen rise above naked-eye visibility. Because the Coma Berenices Cluster spans more than 4°, you'll need optics with a wide field of view to see all the stars simultaneously. Start by using binoculars with front lenses that measure 50mm or larger in aperture, and then move to your telescope and select your lowest-power eyepiece.

Look for these celestial targets nearby:

MICHAEL FULLER

››› **M3,** a magnitude 6.3 globular cluster, lies 14.4° east-northeast.

››› **M53,** a magnitude 7.7 globular cluster, lies 7.4° east-southeast.

››› **NGC 4494**, a magnitude 9.7 elliptical galaxy, lies 5.1° northwest.

››› **NGC 5053,** a magnitude 9.0 globular cluster, lies 8.3° east-southeast.

Look for these celestial targets nearby:

ED HENRY

››› **M58,** a magnitude 9.6 spiral galaxy, lies 1.8° east-southeast.

››› **M84,** a magnitude 9.2 elliptical galaxy, lies 1.5° west-northwest.

››› **M86,** a magnitude 8.9 elliptical galaxy, lies 1.3° west-northwest.

››› **M89,** a magnitude 9.9 elliptical galaxy, lies 1.2° east.

Virgo A statistics

Also known as: M87 and NGC 4486
Right ascension: 12h31m
Declination: 12°24'
Magnitude: 8.6
Apparent size: 7'
Distance: 60 million light-years
Visible: North of latitude 77° S.

to compare celestial luminosities), M87 would appear more than 25,000 times brighter than the Full Moon does in our sky.

Messier discovered M87 March 18, 1781. He described it as a "Nebula without star in Virgo, below and very near an 8 mag. star. This nebula appears to have the same light as the two nebulae, Nos. 84 and 86."

M87 has a large cadre of globular clusters. While the Milky Way has perhaps several hundred globulars, M87 may have as many as 15,000. M87 also has a jet that emanates from its nucleus.

A supermassive black hole powers the jet of electrons and other subatomic particles traveling near light-speed from M87's center. The jet's blue color contrasts with the yellow glow from the combined light of stars that make up this galaxy.

To see the jet, you'll need a 30-inch or larger telescope under a pristine sky. Through smaller scopes, you'll see M87 as perfectly round. A bright core, one-third of the galaxy's size, blazes in the center. Look for two companion galaxies, NGC 4476 and NGC 4478, about 10' west.

With galaxies, letter designations refer to strong radio-wave sources. M87 was Virgo's first radio source, so it received the letter A.

IF YOU LIKE THIS OBJECT, be sure to observe:
The Blackeye Galaxy (M64) — page 33 • The Deer Lick Group (NGC 7331) — page 70 • Cetus A (M77) — page 84

Best seen: **MARCH 30**

21 The Needle Galaxy

Spiral galaxy in Coma Berenices

As spring dawns north of the equator, the galaxies of the Coma-Virgo cluster ride highest in the sky at midnight. Point your telescope at the Needle Galaxy, and you'll see the sky's finest edge-on spiral. Don't confuse the Needle Galaxy with the Silver Needle Galaxy (page 21), which lies 12.5° north-northwest.

Through an 8-inch telescope, you'll see a streak roughly 10' long but only 1.5' thick oriented northwest to southeast. As you increase the size of the telescope you observe through, the apparent length of the Needle Galaxy also increases. A 16-inch scope shows NGC 4565's full extent of 16'.

A dust lane runs the entire length of this object, masking much of the arms' brightness. The central region features a small bulge, and that's the easiest place to detect the dust lane. The dark streak is offset a bit to the north of center because NGC 4565 is inclined 3.5° from edge-on.

If your telescope's aperture is 12 inches or more — and if your sky is nice and dark — try for the magnitude 13.5 galaxy NGC 4562. From the Needle Galaxy, this faint object lies 13' southwest.

Although we see NGC 4565's edge, astronomers speculate that a face-on view of the Needle Galaxy would resemble spiral galaxy M100 (page 23). At its distance of 31 million light-years, NGC 4565 spans more than 150,000 light-years. It resides within the Coma-Sculptor Cloud of galaxies.

Needle Galaxy statistics

Also known as: NGC 4565 and Caldwell 38

Right ascension: 12h36m

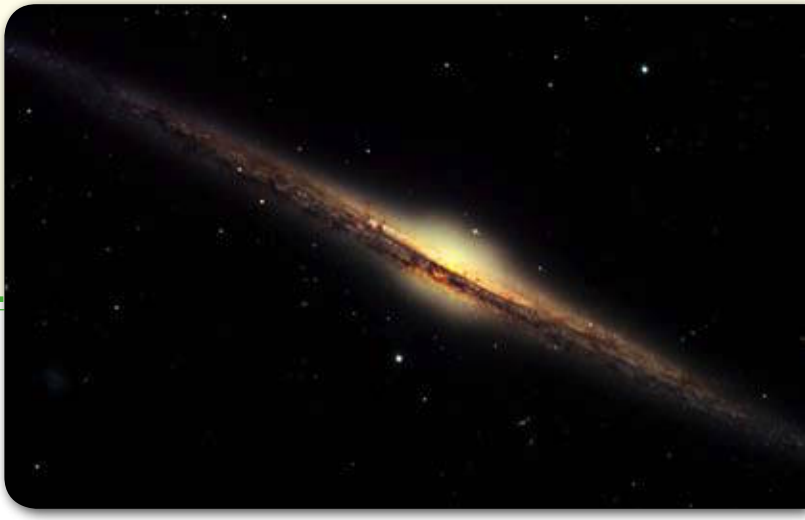
Declination: 25°59'

Magnitude: 9.6

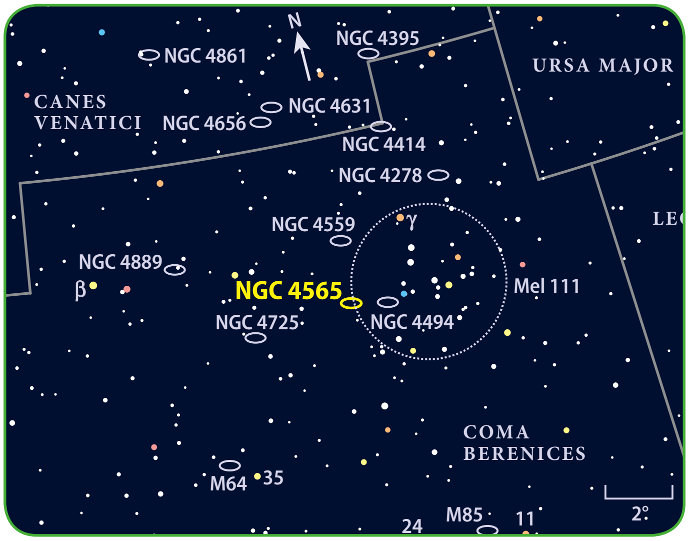
Apparent size: 16' by 3'

Distance: 31 million light-years

Visible: North of latitude 64° S.



THE NEEDLE GALAXY (NGC 4565) in Coma Berenices has a small central bulge. Compare this galaxy's dimensions to those of the Silver Needle Galaxy (page 21). BRUCE HUGO/LESLIE GAUL/ADAM BLOCK/NOAO/AURA/NSF



NGC 4565 lies 8° west-southwest of magnitude 4.2 Beta (β) Canum Venaticorum, and on the eastern edge of the Coma Berenices Star Cluster. Be sure to check out the other interesting galaxies here.

Look for these celestial targets nearby:

- **NGC 4278,** a magnitude 10.1 elliptical galaxy, lies 4.9° northwest.
- **NGC 4559,** a magnitude 9.6 spiral galaxy, lies 2° north.
- **NGC 4725,** a magnitude 9.3 spiral galaxy, lies 3.2° east.
- **NGC 4889,** a magnitude 11.5 elliptical galaxy, lies 5.6° east-northeast.

NGC 4559

JEFF HAPEMAN/ADAM BLOCK/NOAO/AURA/NSF

IF YOU LIKE THIS OBJECT, be sure to observe:

The Silver Needle Galaxy (NGC 4244) — page 21 • M106 — page 22 • The Silver Coin Galaxy (NGC 253) — page 76

Best seen: **MARCH 31**

22 The Sombrero Galaxy

Spiral galaxy in Virgo

Deep within the constellation Virgo's heart lies a showpiece spiral galaxy guaranteed to delight amateur astronomers and the general public alike. The Sombrero Galaxy is undoubtedly one of the finest objects you can see through a small telescope.

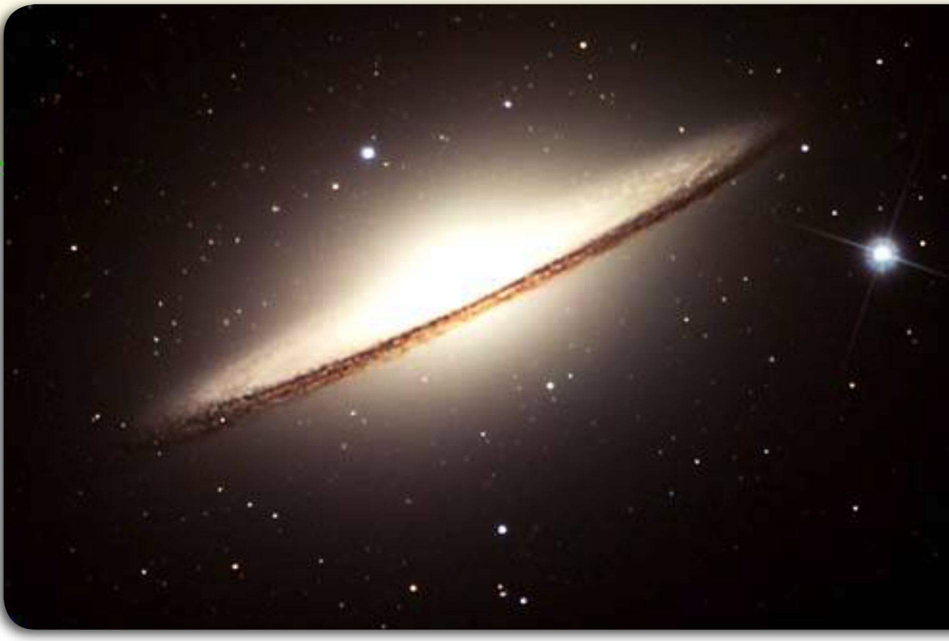
Historians usually give Pierre Méchain credit for discovering M104 because he mentions it in a letter dated May 6, 1783: "On May 11, 1781, I have discovered a nebula above Corvus; it did not appear to me to contain stars; it is faint & very difficult to see when the wires of the micrometer are illuminated."

Messier wrote a note on his 1784 copy of his catalog stating he had observed the Sombrero on the same date Méchain found it. William Herschel made an independent discovery of this object May 9, 1784.

M104 was the first galaxy to have a large redshift detected. Redshift refers to the direction of motion away from us caused by the universe's expansion. In 1912, American astronomer Vesto M. Slipher (1875–1969) discovered the Sombrero Galaxy was moving away from us at a speed of 2.2 million mph (3.6 million km/h).

The Sombrero Galaxy's lens shape and the dark dust lane that splits it are easy to spot through any size telescope. The galaxy's two sections have unequal brightnesses — the northern half outshines the southern because M104 inclines 6° to our line of sight. The dust lane, therefore, appears to cross south of the central lane.

Through a 4-inch telescope, you may detect the dust lane only near the Sombrero's center. The core is bright, and a large halo surrounds it, even extending above and below the sections of the spiral arms nearest the nucleus.



THE SOMBRERO GALAXY (M104) resembles Saturn through a telescope. The dark lane is easiest to see in front of M104's bright nucleus. MORRIS WADE/ADAM BLOCK/NOAO/AURA/NSF

Look for these celestial targets nearby:

- ››› **NGC 3962,** a magnitude 10.7 elliptical galaxy, lies 11.3° west-southwest.
- ››› **NGC 4361,** a magnitude 10.9 planetary nebula, lies 8° south-southwest.
- ››› **NGC 4699,** a magnitude 9.6 spiral galaxy, lies 3.7° northeast.
- ››› **NGC 4783,** a magnitude 11.7 elliptical galaxy, lies 3.7° east-southeast.

Sombrero Galaxy statistics

Also known as: the Saturn Galaxy, M104, and NGC 4594

Right ascension: 12h40m

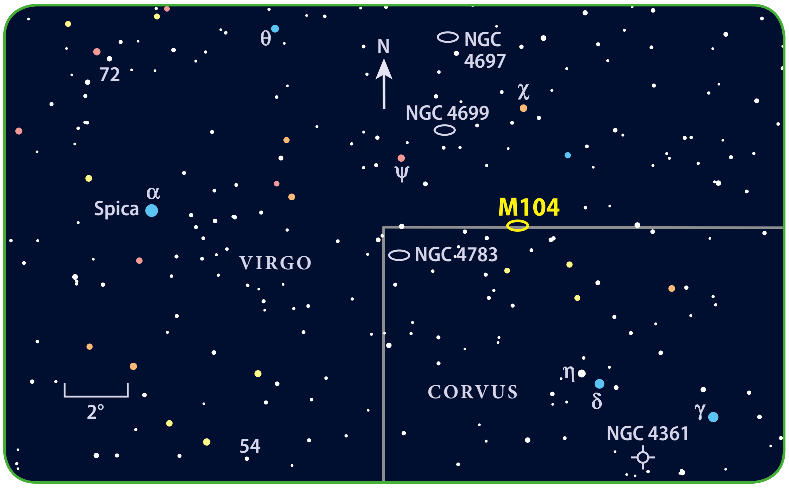
Declination: –11°37'

Magnitude: 8.0

Apparent size: 9' by 4'

Distance: 50 million light-years

Visible: South of latitude 70° N.



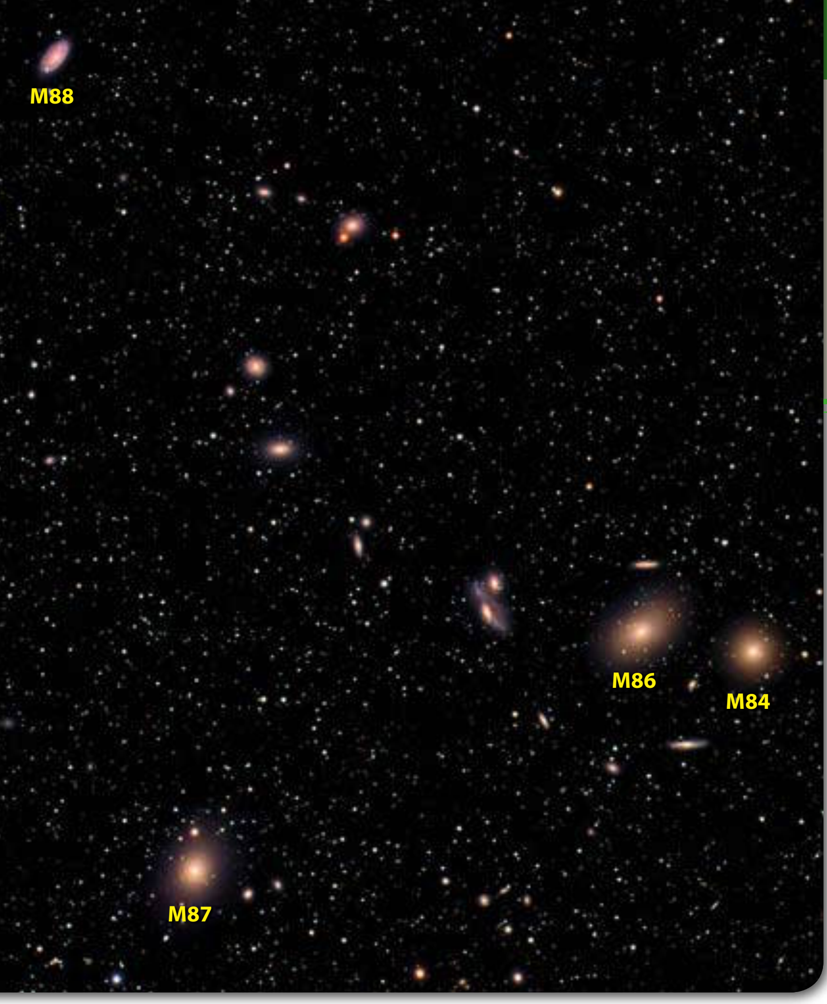
THE SOMBRERO GALAXY (M104) sits 4° west-southwest of magnitude 4.8 Psi (ψ) Virginis, less than 0.1° north of Virgo's border with the constellation Corvus the Crow.

IF YOU LIKE THIS OBJECT, be sure to observe:
M94 — page 30 • **The Southern Whirlpool Galaxy (M83)** — page 38 • **NGC 891** — page 82

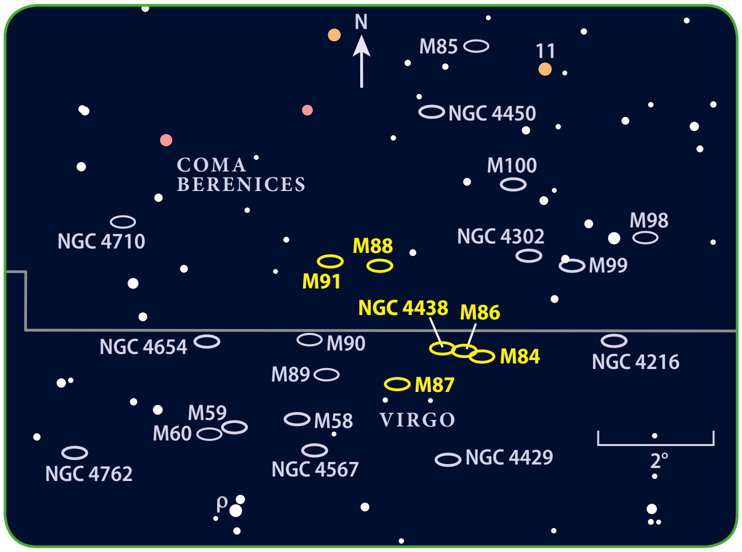
Best seen: **MARCH 31**

23 Markarian's Chain

Galaxy group in Coma Berenices and Virgo



NAMED IN HONOR **of Armenian astronomer Beniamin Markarian, Markarian's Chain contains the brightest galaxies of northern Virgo and southern Coma Berenices.** JAY BALLAUER



MARKARIAN'S CHAIN **stretches some 10° from the northeast (in Coma Berenices) to the southwest (in Virgo).**

Nineteenth-century observers called the area bounded by the stars Arcturus, Spica, and Denebola the "realm of the nebulae." They weren't describing nebulae in the current sense, however. Their nebulae were galaxies, which looked nebulous through the small telescopes most observers used.

Across the heart of this region stretches Markarian's Chain, a group of galaxies bounded on the west by the large lenticular (lens-shaped) galaxies M84 and M86. From those two giants, the chain swings to the northeast. Where it ends depends on your perspective.

Some observers end the chain at NGC 4477. Others swing northwest from that galaxy and include NGC 4459. The chain's name honors Armenian astronomer Beniamin Egishevich Markarian (1913–1985), who discovered an energetic class of galaxies.

The key to observing this region is a good finder chart. Orient it so it matches your eyepiece's field of view. The finder chart will show a lot more area and objects, of course. What you want is to move your scope left, right, up, and down and have those directions correspond to your chart.

If you have a 12-inch or larger telescope, pay attention to NGC 4435 and NGC 4438, a pair of galaxies called the Eyes (or Markarian's Eyes). This duo lies 23' east of M86. Gravitational interaction between these galaxies is tearing them apart.

Astronomers estimate the two passed within 16,000 light-years of each other sometime in the past. NGC 4438 is the more distorted galaxy. Try to spot this object's irregular outer regions.

Markarian's Chain statistics

Prominent members include: M84, M86, M87, and M88

Right ascension: 12h40m

Declination: 13°

Magnitude: various

Apparent size: various

Distances: various

Visible: North of latitude 77° S.

PAUL AND DANIEL KOBLAS/ADAM BLOCK/ NOAO/AURA/NSF

Look for these celestial targets nearby:

››› **M60,** a magnitude 8.8 elliptical galaxy, lies 4° east-southeast.

››› **M88,** a magnitude 9.4 spiral galaxy, lies 1.9° east.

››› **M90,** a magnitude 11.9 spiral galaxy, lies 2.2° east.

››› **NGC 4450,** a magnitude 10.1 spiral galaxy, lies 3.7° north.

IF YOU LIKE THIS OBJECT, be sure to observe:

NGC 2403 — page 10 • **The Cigar Galaxy (M82)** — page 16 • **Centaurus A (NGC 5128)** — page 34

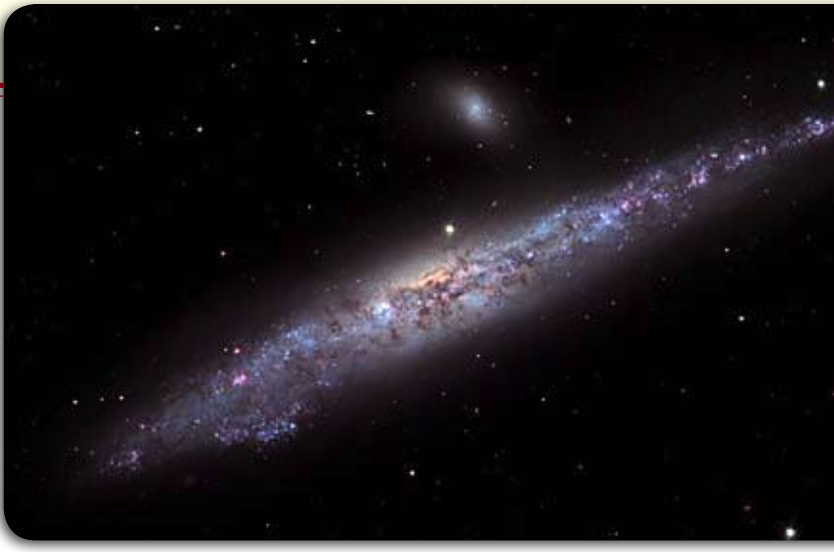
Best seen: **APRIL 1**

24 The Whale Galaxy

Spiral galaxy in Canes Venatici

Whale Galaxy statistics

Also known as: Herring Galaxy, NGC 4631, and Caldwell 32
Right ascension: 12h42m
Declination: 32°32'
Magnitude: 9.8
Apparent size: 17' by 4'
Distance: 30 million light-years
Visible: North of latitude 57° S.



THE WHALE GALAXY (NGC 4631) travels through space with a small companion: elliptical galaxy NGC 4627. JOHN VICKERY/JIM MATTHES/ADAM BLOCK/NOAO/AURA/NSF

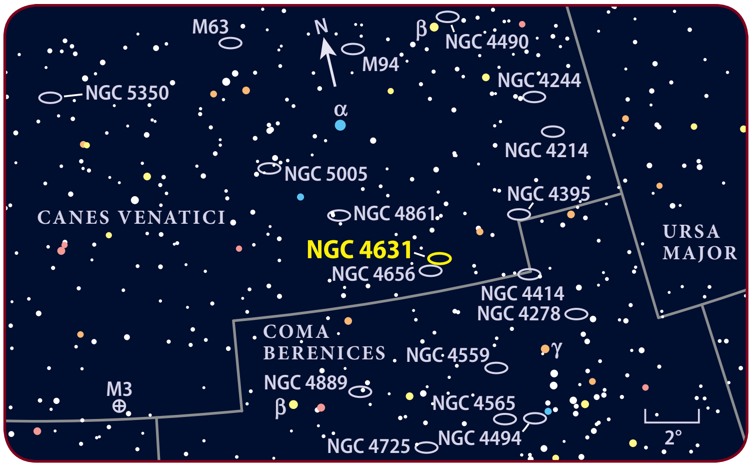
At first glance, the Whale Galaxy, with its bulging core and uneven distribution of gas and stars doesn't look like an edge-on spiral galaxy. Yet this object is one of the sky's brightest edge-on galaxies.

William Herschel discovered NGC 4631 March 20, 1787. Through a 6-inch scope, you'll see an imperfect lens shape that's bigger and brighter on one side.

Larger scopes will reveal NGC 4631's companion — dwarf spheroidal galaxy NGC 4627, which sits 2.5' northwest. NGC 4627's gravity has distorted the Whale's spiral structure. In fact, the largest telescopes reveal a bridge of material connecting the two galaxies.

For the Whale Galaxy, the close passage of NGC 4627 has stirred things up. The central region of NGC 4631 is a maelstrom of star formation. Huge clumps of stars lie all along the spiral arms. If you're lucky enough to observe NGC 4631 through a 16-inch or larger scope, look for dark areas made of dust and cold gas amidst the galaxy's bright glowing regions.

Lots of star formation means lots of young, massive stars exploding as supernovae. NGC 4631 has seen so many supernovae that a "superwind" is blowing out of it. The gas expelled by this superwind has formed a sphere of hot, X-ray emission that surrounds the Whale Galaxy.



WHEN STAR-HOPPING to the Whale Galaxy, start with Cor Caroli (Alpha [α] Canum Venaticorum) and move 6.5° south-southwest. Don't miss the Hockey Stick Galaxy (NGC 4656), which sits only 0.5° southeast of the Whale.

The Hockey Stick Galaxy

CHRIS SCHUR

Look for these celestial targets nearby:

››› **NGC 4395,** a magnitude 10.0 spiral galaxy, lies 3.5° west-northwest.

››› **NGC 4414,** a magnitude 10.3 spiral galaxy, lies 3.6° west-southwest.

››› **The Hockey Stick Galaxy (NGC 4656),** a magnitude 10.1 spiral galaxy, lies 0.5° southeast.

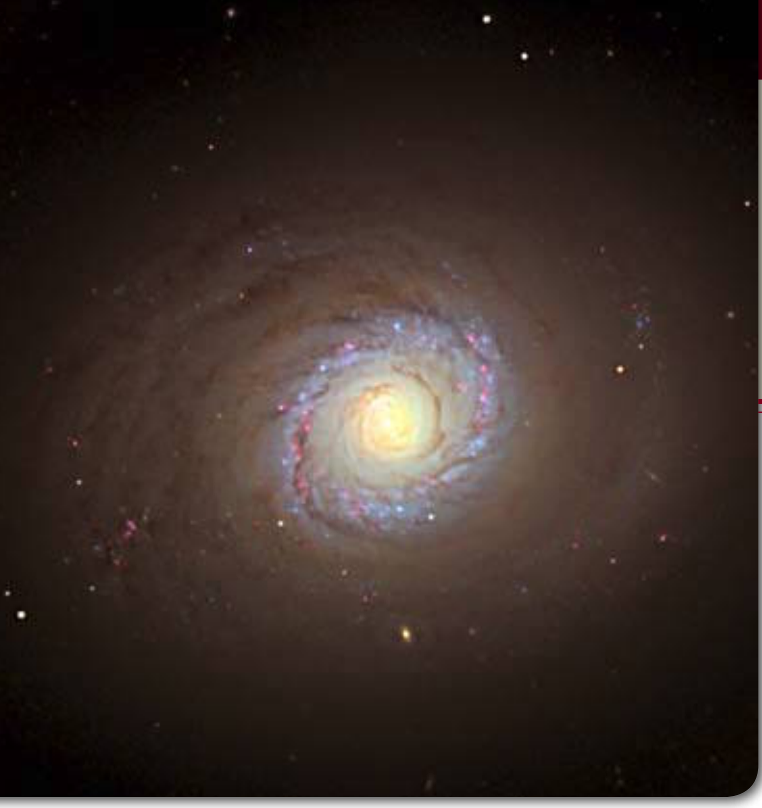
››› **NGC 4861,** a magnitude 13.5 spiral galaxy, lies 4.2° northeast.

IF YOU LIKE THIS OBJECT, be sure to observe:
Bode's Galaxy (M81) — page 15 • NGC 6946 — page 60 • The Andromeda Galaxy (M31) — page 75

Best seen: **APRIL 2**

25 M94

Spiral galaxy in Canes Venatici



THROUGH A SMALL TELESCOPE, don't classify M94 in Canes Venatici as an elliptical galaxy. Look closer, and try to spot its tightly wound arms. ADAM BLOCK/NOAO/AURA/NSF

When does a face-on spiral galaxy not look like a spiral galaxy? When it's M94. This notable object — the brightest galaxy in Canes Venatici — has its spiral arms wrapped tightly around it. Through small telescopes, most observers might classify it as an elliptical galaxy.

Pierre Méchain discovered M94 March 22, 1781. After receiving Méchain's report, Messier observed M94, determined its position, and added it to his catalog 2 days later.

British astronomer and author Admiral William H. Smyth (1788–1865) gave a more detailed description, but it certainly doesn't describe a galaxy: "A comet-like nebula; a fine, pale-white object with evident symptoms of being a compressed cluster of small stars. It brightens toward the middle."

Through an 8-inch scope, you'll see the tiny nucleus surrounded by a bright disk that measures only 30" across. A much fainter oval halo surrounds the disk. Increase your telescope's aperture to 16 inches, and you'll begin to see the tightly wound spiral arms close to the nucleus.

If you attend a large star party in the spring or early summer, seek out the largest telescope there, and ask the owner for a look at M94 at high magnification. Be patient, and wait for moments of good seeing. Then, within the spiral arms you'll see several small, dark dust lanes. The largest of these separate the arms from one another. 100

M94 statistics

Also known as: NGC 4736

Right ascension: 12h51m

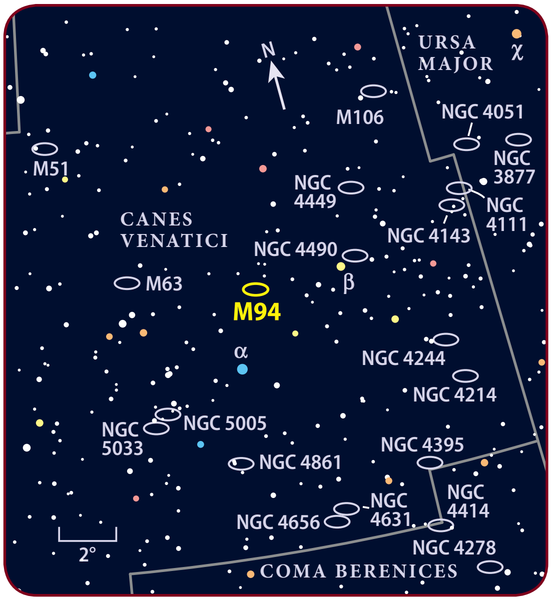
Declination: 41°07'

Magnitude: 8.2

Apparent size: 7' by 3'

Distance: 14.5 million light-years

Visible: North of latitude 50° S.



SPIRAL GALAXY
M94 makes an isosceles triangle with Alpha (α) and Beta (β) Canum Venaticorum. The magnitude 8.2 spiral galaxy lies roughly 3° from each star.

Look for these celestial targets nearby:

JOE NAUGHTON AND STEVE STAFFORD/ADAM BLOCK/NOAO/AURA/NSF

- ››› **NGC 4214,** a magnitude 9.6 irregular galaxy, lies 8.4° west-southwest.
- ››› **NGC 4244,** a magnitude 10.0 spiral galaxy, lies 7.2° west-southwest.
- ››› **NGC 4490,** a magnitude 9.5 spiral galaxy, lies 3.8° west.
- ››› **NGC 5005,** a magnitude 9.8 spiral galaxy, lies 5.6° southeast.

IF YOU LIKE THIS OBJECT, be sure to observe:
Bode's Galaxy (M81) — page 15 • **The Blackeye Galaxy (M64)** — page 33 • **NGC 891** — page 82

Best seen: **APRIL 4**

26 The Coalsack

Dark nebula in Crux

Coalsack statistics

Also known as: Magellan's Spot, the Black Magellanic Cloud, and Caldwell 99

Right ascension: 12h52m

Declination: –63°18'

Magnitude: —

Apparent size: 420' by 240'

Distance: 600 light-years

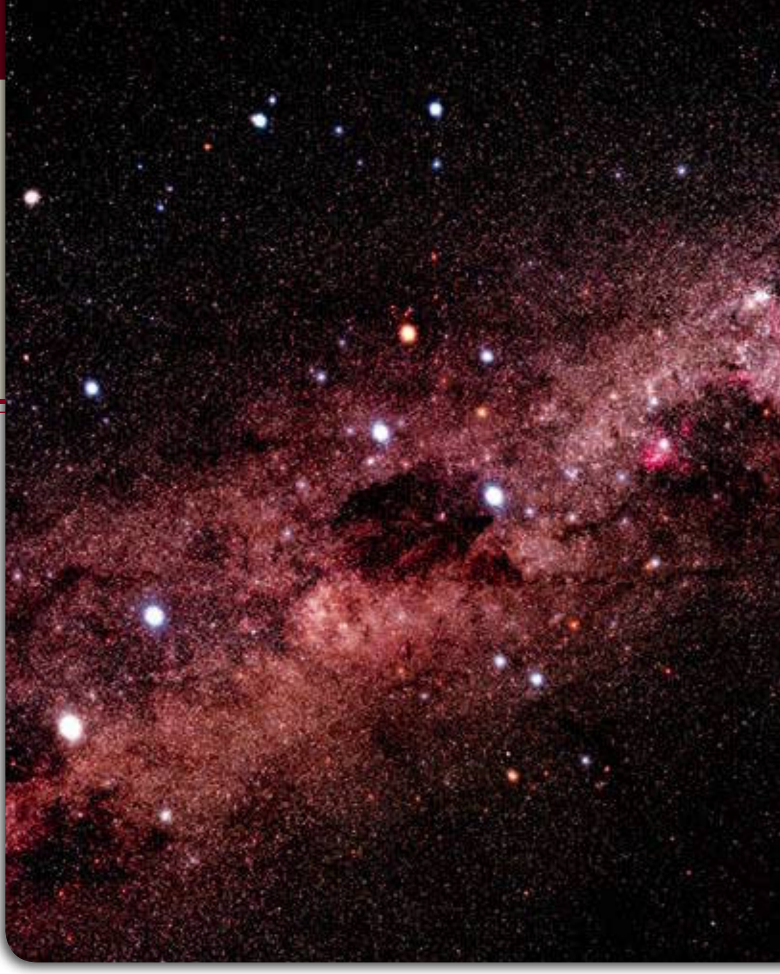
Visible: South of latitude 26° N.

Although Crux the Southern Cross is the smallest of the 88 constellations, it's also the brightest. Any dark object, therefore — especially one as large as the Coalsack — will stand out.

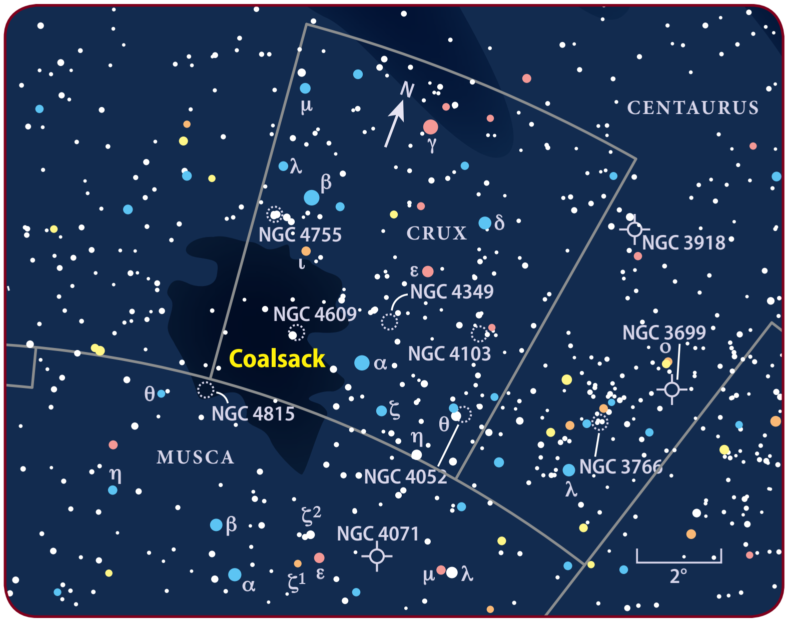
The Coalsack has the greatest impact as a naked-eye object. Optics restrict the field of view, thus lessening the contrast with the bright Milky Way star field. Also, binoculars and telescopes reveal the Coalsack is not devoid of stars, and that takes away from its appeal.

The Coalsack falls mainly within the boundaries of Crux, but parts of it lie in Musca and Centaurus. And although we can't give a discovery date — Southern Hemisphere residents had seen it for thousands of years — Spanish explorer Vincente Yánez Pinzón (*ca.* 1460–1525) reported observing it in 1499.

The Coalsack figured into Australian Aborigines' sky mythology. A popular myth says the Coalsack is the head of the Emu. From Crux, the Emu's dark clouds stretch along the Milky Way through Centaurus, Circinus, Norma, and Scorpius.



THE COALSACK in Crux looks like a hole in the starry sky, but it's really a cloud of dark dust and cold gas. LUKE DODD



THE COALSACK lies 3° east of Alpha (α) Crucis. You'll spot it easily with your unaided eyes, but binoculars really make it stand out.

Look for these celestial targets nearby:

DANIEL VERSCHATSE

- ››› **NGC 4349,** a magnitude 7.4 open cluster, lies 3.5° west-northwest.
- ››› **NGC 4609,** a magnitude 6.9 open cluster, lies 1.2° west.
- ››› **NGC 4815,** a magnitude 8.6 open cluster, lies 2° south-southeast.
- ››› **NGC 5189,** a magnitude 10.0 planetary nebula, lies 5.3° south-southeast.

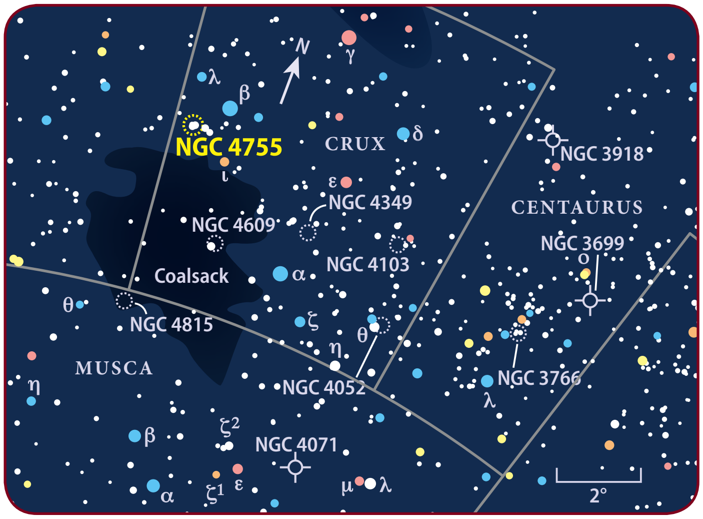
IF YOU LIKE THIS OBJECT, be sure to observe:

The Snake Nebula — page 45 • The Ink Spot (B86) — page 48 • IC 1396 — page 66

Best seen: **APRIL 4**

27 The Jewel Box Cluster

Open cluster in Crux

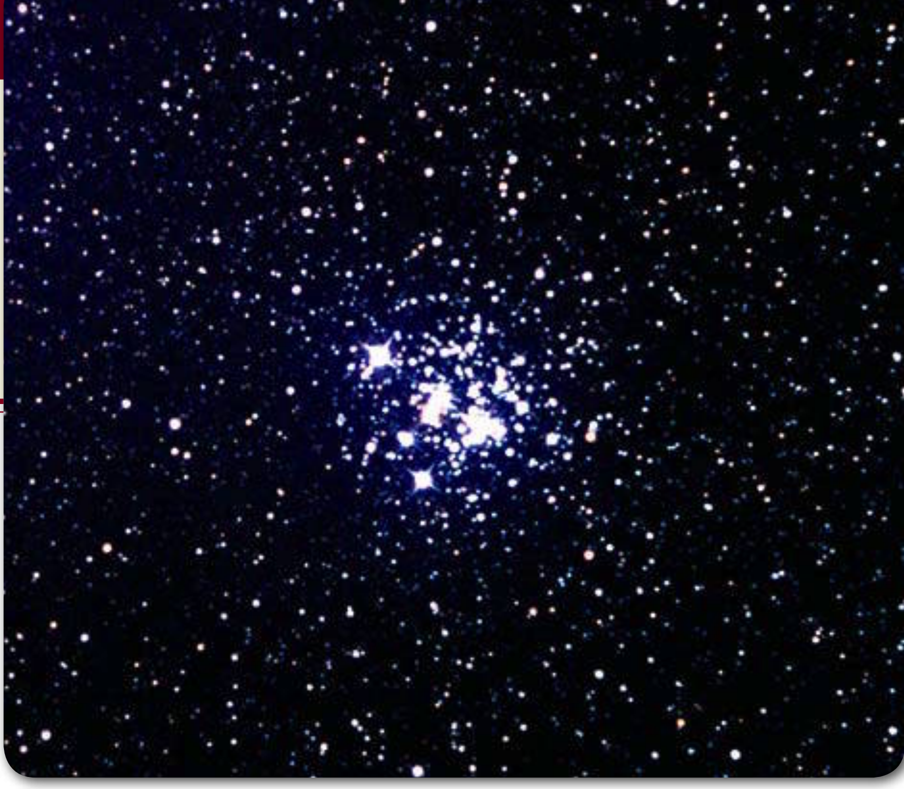


AT MAGNITUDE 4.2, the fabulous Jewel Box Cluster is a celestial object you won't have to star-hop to find.

Look for these celestial targets nearby:

DANIEL VERSCHATSE

- ››› **NGC 4071,** a magnitude 13.0 planetary nebula, lies 8.8° south-southwest.
- ››› **NGC 4372,** a magnitude 7.2 globular cluster, lies 12.6° south.
- ››› **NGC 5281,** a magnitude 5.9 open cluster, lies 6.8° east-southeast.
- ››› **NGC 5316,** a magnitude 6.0 open cluster, lies 7.4° east-southeast.



THE JEWEL BOX CLUSTER (NGC 4755) is a beautiful celestial object through any size telescope. Several of its stars show strong color. GREGG THOMPSON

Many amateur astronomers consider the Jewel Box Cluster the sky's finest open cluster. It's not the biggest or the brightest, or even the most populous. The reason NGC 4755 stops so many observers in their tracks is its colorful stars.

Most open clusters contain hot, recently formed blue stars, which appear white through a telescope. The Jewel Box, however, contains about a dozen stars of various shades of blue, yellow, and orange.

French astronomer Nicolas Louis de Lacaille (1713–1762) discovered NGC 4755 during his trip to South Africa in 1751–2. English astronomer Sir John Herschel's (1792–1871) eloquent description led to other astronomers coining the popular name "Jewel Box."

Herschel said, "This cluster, which though neither a large nor a rich one, is yet an extremely brilliant and beautiful object when viewed through an instrument of sufficient aperture to show distinctly the very different colour of its constituent stars, which give it the effect of a superb piece of fancy jewellery."

NGC 4755's alternate proper name, the Kappa Crucis Cluster, does not derive from a single star because no star in the cluster is bright enough to have garnered such attention. "Kappa," instead, refers to the entire cluster.

A 6-inch telescope and an eyepiece that yields 50x may be the best combination with which to view NGC 4755. Through this setup, you'll see nearly a dozen stars that exhibit color, 20 additional white stars, and a faint backdrop made up of some 200 cluster members. 100

Jewel Box statistics

Also known as: Kappa Crucis Cluster, NGC 4755, and Caldwell 94
Right ascension: 12h54m
Declination: –60°22'
Magnitude: 4.2
Apparent size: 10'
Distance: 6,500 light-years
Visible: South of latitude 29° N.

IF YOU LIKE THIS OBJECT, be sure to observe:
The Tau CMa Cluster (NGC 2362) — page 8 • The Double Cluster (NGC 869 and NGC 884) — page 81 • M35 — page 96

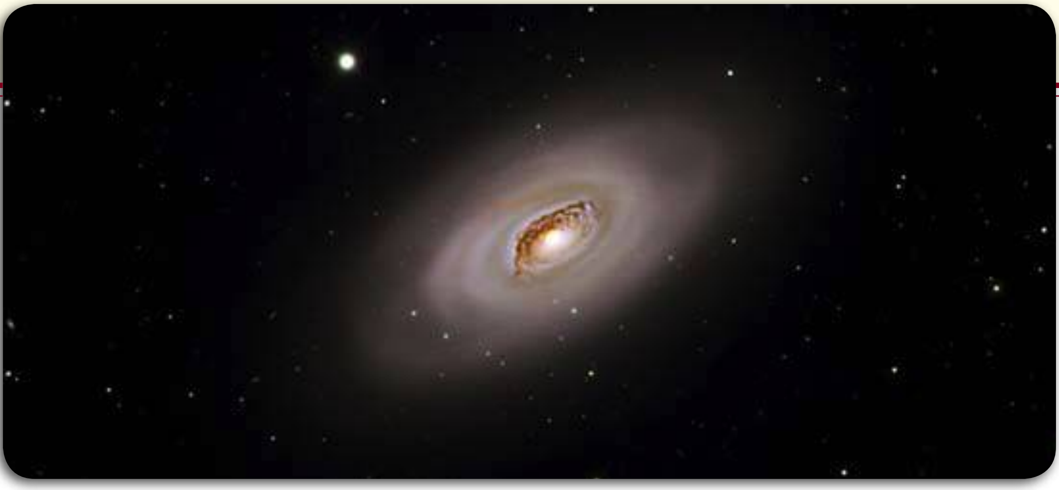
Best seen: **APRIL 5**

28 The Blackeye Galaxy

Spiral galaxy in Coma Berenices

Blackeye Galaxy statistics

Also known as: the Sleeping Beauty Galaxy, M64, and NGC 4826
Right ascension: 12h57m
Declination: 21°41'
Magnitude: 8.5
Apparent size: 9.3' by 5.4'
Distance: 19 million light-years
Visible: North of latitude 68° N.



THE BLACKEYE GALAXY (M64) in Coma Berenices has a dark, dusty structure near its core that blocks more distant starlight. You'll need a big telescope to resolve the closely wound spiral arms. KEN CRAWFORD

Although the tiny constellation Coma Berenices occupies less than 1 percent of the sky, you'll spend a lot more than 1 percent of your observing time here. Coma Berenices represents the hair of Berenice, wife of King Ptolemy III Euergetes of Egypt, who reigned from 246 to 222 B.C. And nestled in those golden tresses — in the constellation's center — lies the Blackeye Galaxy.

English astronomer Edward Pigott (1753–1825) discovered M64 March 23, 1779. Messier independently found it a year later and added it to his catalog. In 1785, Sir William Herschel discovered this galaxy's dark dust feature, which he compared to a black eye. Other astronomers liked the name, and it caught on.

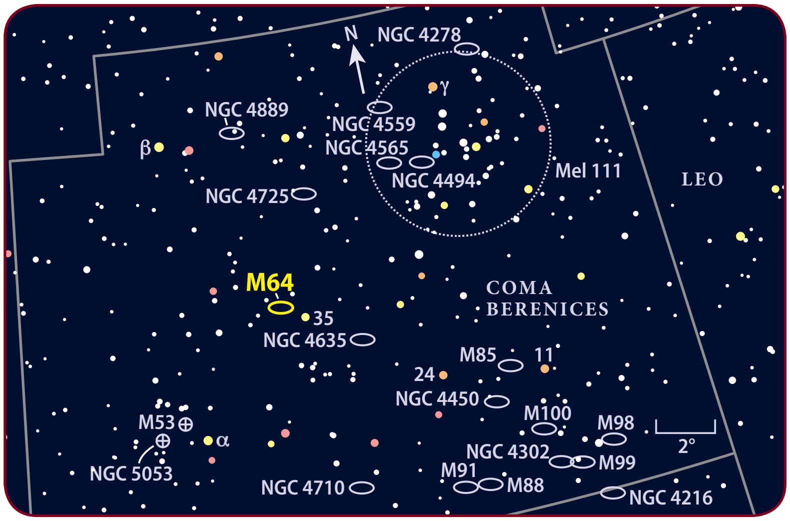
The dust lane is prominent, but only when viewed through a 10-inch or larger telescope. Through smaller instruments, you'll just see a gradual fading. The lane sits north of the nucleus, separating the core from the northern spiral arm.

The arms wrap tightly around the core, so you'll need a 16-inch scope to see any detail in them. If you view through this size scope, look for a halo formed by the arms' outer regions. 100

CHRIS SCHUR

Look for these celestial targets nearby:

- ››› **M49,** a magnitude 8.3 elliptical galaxy, lies 15.1° south-southwest.
- ››› **M59,** a magnitude 9.7 elliptical galaxy, lies 10.6° south-southwest.
- ››› **M61,** a magnitude 9.3 spiral galaxy, lies 19.2° south-southwest.
- ››› **NGC 4635,** a magnitude 12.7 spiral galaxy, lies 3.7° west-southwest.



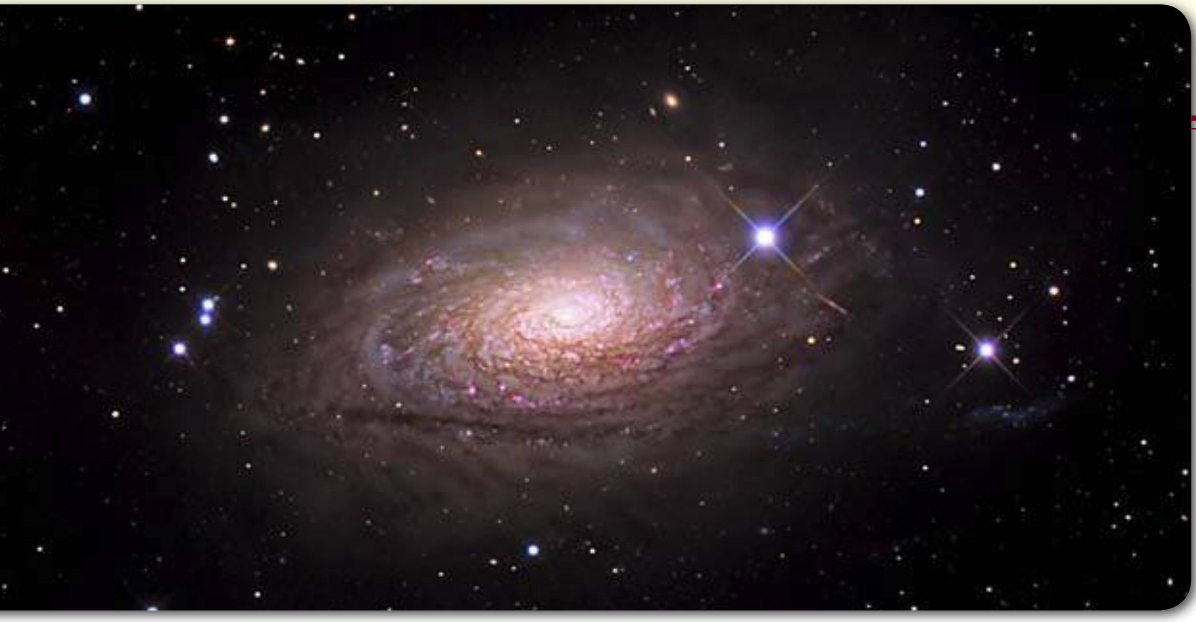
TO FIND M64, start at magnitude 4.3 Alpha (α) Comae Berenices, and head 5.5° northwest to 35 Com. Then move 0.9° east-northeast.

IF YOU LIKE THIS OBJECT, be sure to observe:
The Cigar Galaxy (M82) — page 16 • Barnard's Galaxy (NGC 6822) — page 56 • NGC 1365 — page 86

Best seen: **APRIL 10**

29 The Sunflower Galaxy

Spiral galaxy in Canes Venatici



THE SUNFLOWER GALAXY (M63) in Canes Venatici contains details a small telescope won't reveal. For the best views — especially of the galaxy's spiral structure — use a 10-inch or larger scope. R. JAY GaBANY

Sunflower Galaxy statistics

Also known as: M63 and NGC 5055
Right ascension: 13h16m
Declination: 42°02'
Magnitude: 8.6
Apparent size: 10' by 6'
Distance: 37 million light-years
Visible: North of latitude 48° S.

As spring begins to take hold in the Northern Hemisphere, the Sunflower Galaxy blooms near the Big Dipper. Target it, and images of summertime fields will dance through your head.

Pierre Méchain discovered this galaxy June 14, 1779. It marked the first of his deep-sky finds. He

Best seen: **APRIL 13**

30 Centaurus A

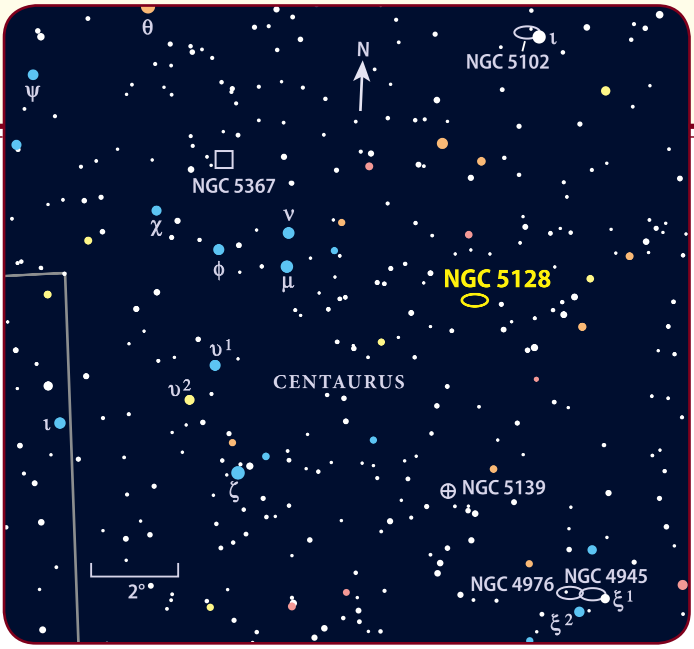
Peculiar galaxy in Centaurus

Centaurus A statistics

Also known as: NGC 5128 and Caldwell 77
Right ascension: 13h26m
Declination: –43°01'
Magnitude: 7.0
Apparent size: 18'
Distance: 15 million light-years
Visible: South of latitude 46° N.

Seeing Centaurus A high in the sky is one of the thrills of Southern Hemisphere observing. Unfortunately, most northern viewers get only a taste of this object's details. For example, from Tucson, Arizona, NGC 5128 climbs to a maximum altitude of 15°. Viewing any object through that much of Earth's atmosphere presents a distorted view. For best results, head farther south.

Australian astronomer James Dunlop (1793–1848) discovered NGC 5128 and published the observation in a list of 629 objects titled *A catalogue of nebulae and clusters of stars in the southern hemisphere,*



YOU WON'T SEE 7TH-MAGNITUDE CENTAURUS A with your naked eyes. Instead, using binoculars or a telescope, find the bright globular cluster Omega Centauri (NGC 5139), and move 4.5° north.

IF YOU LIKE THIS OBJECT, be sure to observe:
M100 — page 23 • The Southern Whirlpool Galaxy (M83) — page 38 • NGC 6946 — page 60

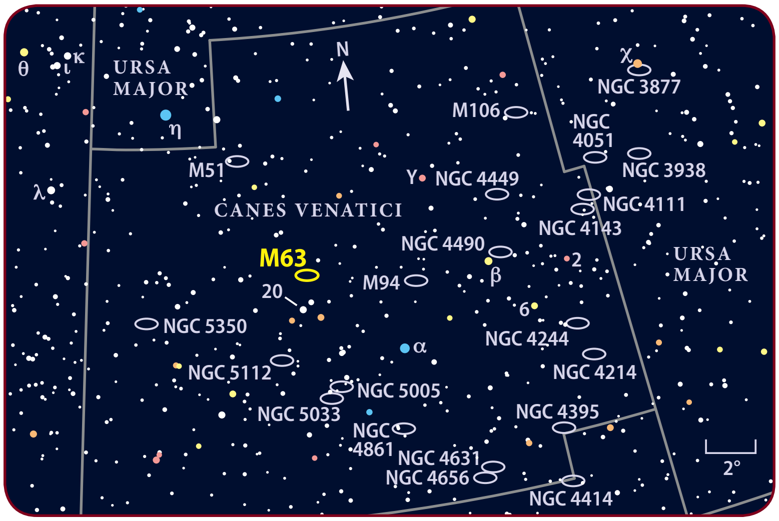
reported it to his friend Charles Messier, who put it in his catalog. When Admiral William H. Smyth observed it in 1836, he saw, "An oval nebula on the chest of Asterion, the northern dog. This object is of a milky-white tint, and brightens to the centre, where the nucleus resembles a small [faint] star."

M63 lies 5.7° from the Whirlpool Galaxy (page 37), and both of these objects belong to the M51 galaxy group. NGC 5195 (the Whirlpool Galaxy's companion) plus five galaxies fainter than magnitude 12.3 round out the collection.

Although it's called the sunflower, M63 tips 60° to our line of sight. American astronomer and writer Robert Burnham, Jr., (1931–1993) described the "look" of M63: "The outer arms are rather reminiscent of showers of sparks thrown out by a rotating fiery pinwheel."

Through small telescopes, M63's nucleus appears stellar, and a 3' long oval halo surrounds it. Through a 10-inch telescope, the halo shows clumpy structure formed by stellar associations and star-forming regions within M63's spiral arms.

Outside the nucleus, the arms fade with increasing distance. Through even large amateur telescopes, you'll see only hints of the many spiral arms that radiate outward. Some astronomers refer to M63 and similar galaxies as "flocculent" spirals — those having only patchy, localized spiral structure.



M63 CARVES OUT ITS OWN SECTION OF SKY in a galaxy-rich region. It sits north of a group of four stars that include 19, 20, and 23 Canum Venaticorum.

Look for these celestial targets nearby:

- ››› **NGC 5033,** a magnitude 10.0 spiral galaxy, lies 5.5° south.
- ››› **NGC 5112,** a magnitude 11.6 spiral galaxy, lies 3.5° south-southeast.
- ››› **NGC 5350,** a magnitude 11.6 spiral galaxy, lies 7.3° east.
- ››› **IC 4182,** a magnitude 11.1 spiral galaxy, lies 4.8° south-southwest.

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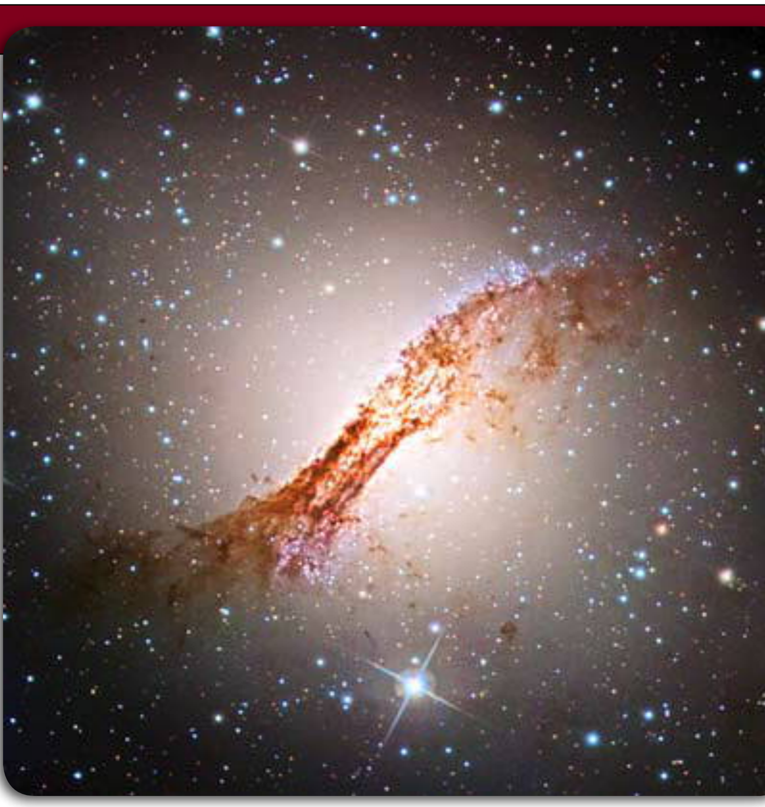
observed at Parramatta in New South Wales, which appeared in the Philosophical Transactions of the Royal Society, Volume 118, 1828.

NGC 5128's appearance arises from a galactic collision. The main body of Centaurus A — a giant elliptical galaxy — is absorbing a smaller spiral galaxy. The two objects collided more than 200 million years ago, causing huge bouts of star formation. Centaurus A also emits radio waves, X rays, and gamma rays strongly. Most astronomers agree a supermassive black hole at NGC 5128's center accounts for much of the X-ray and gamma-ray radiation.

Through small telescopes, NGC 5128 appears round with a wide, dark lane cutting the galaxy in half. Use a 12-inch or larger scope, and you'll see a thin wedge of light shining through the lane's western end. That lane widens on both ends.

Look for these celestial targets nearby:

- ››› **NGC 5102,** a magnitude 9.5 elliptical galaxy, lies 6.4° north.
- ››› **NGC 5367,** an emission nebula, lies 6.8° east-northeast.
- ››› **NGC 5643** a magnitude 10.2 elliptical galaxy, lies 12.2° east.
- ››› **Abell 3526,** a magnitude 11.5 elliptical galaxy, lies 1° southwest.



PECULIAR GALAXY CENTAURUS A (NGC 5128) SHINES at a bright magnitude 7, but it's also large, so its surface brightness is low. The dust lane is easy to spot. DANIEL VERSCHATSE

IF YOU LIKE THIS OBJECT, be sure to observe:
The Cigar Galaxy (M82) — page 16 • The Sombrero Galaxy (M104) — page 27 • The Small Magellanic Cloud — page 77

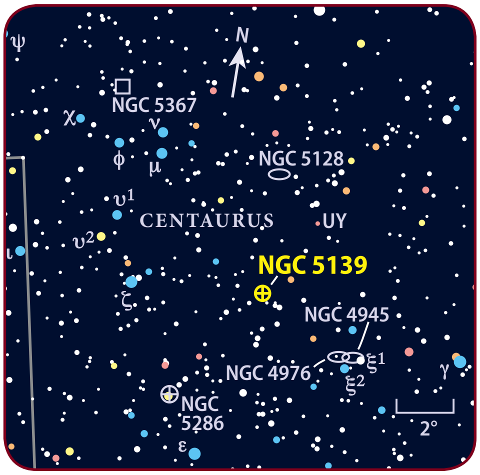
Best seen: **APRIL 13**

31 Omega Centauri

Globular cluster in Centaurus

OMEGA CENTAURI (NGC 5139) is the brightest globular cluster in the sky. This colossus contains more than a million stars. DANIEL VERSCHATSE

THE SKY'S BRIGHTEST GLOBULAR CLUSTER, Omega Centauri (NGC 5139) lies outside the Milky Way's diffuse band not quite 5° west of magnitude 2.6 Zeta (ζ) Centauri.



Centaurus contains the nearest star system to our own, that of the spectacular double star Alpha (α) Centauri and many notable galaxies like Centaurus A (page 34). For amateur astronomers, however, the biggest draw to this constellation is the sky's top globular cluster — Omega Centauri.

NGC 5139 does not have the common name "Omega" because of its shape, as in the case of the Omega Nebula (page 49). Rather, it appeared as a "star" labeled with the Greek letter Omega (ω) on German cartographer Johann Bayer's (1572–1625) 1603 star atlas *Uranometria*. Bayer labeled stars with Greek letters to designate their brightnesses within constellations. Usually (but not always), he assigned the first Greek letter, Alpha (α), to the brightest star; Beta (β), the second letter, was next; and so on. Because Bayer interpreted a historical listing of NGC 5139 as a star, he assigned it the letter Omega.

Omega Centauri is a wonder to behold through binoculars or telescopes of any size. The cluster appears slightly larger than the Full Moon, and, because it's rotating relatively quickly, its shape is slightly out-of-round. Through an 8-inch telescope, you'll see 1,000 stars, each a pinprick of light.

At high power, the stars appear nearly uniformly distributed across the field of view. Through scopes with apertures larger than 16 inches, crank up the magnification, and look for individual red supergiants within this cluster.

NGC 5139's 3 million solar-masses make it the Milky Way's most massive globular cluster. It may be the core of a dwarf elliptical galaxy whose outer envelope has been disrupted by gravitational tides from our galaxy.

Omega Centauri statistics

Also known as: NGC 5139 and Caldwell 80

Right ascension: 13h27m

Declination: –47°29'

Magnitude: 3.5

Apparent size: 55'

Distance: 16,000 light-years

Visible: South of latitude 42° N.

DANIEL VERSCHATSE

Look for these celestial targets nearby:

››› **NGC 4945,** a magnitude 8.6 spiral galaxy, lies 4° west-southwest.

››› **NGC 4976,** a magnitude 10.1 elliptical galaxy, lies 3.6° southwest.

››› **NGC 5286,** a magnitude 7.4 globular cluster, lies 5° southeast.

››› **NGC 5749,** a magnitude 8.8 open cluster, lies 14.6° southeast.

IF YOU LIKE THIS OBJECT, be sure to observe:

M22 — page 49 • **M15** — page 65 • **47 Tucanae (NGC 104)** — page 74

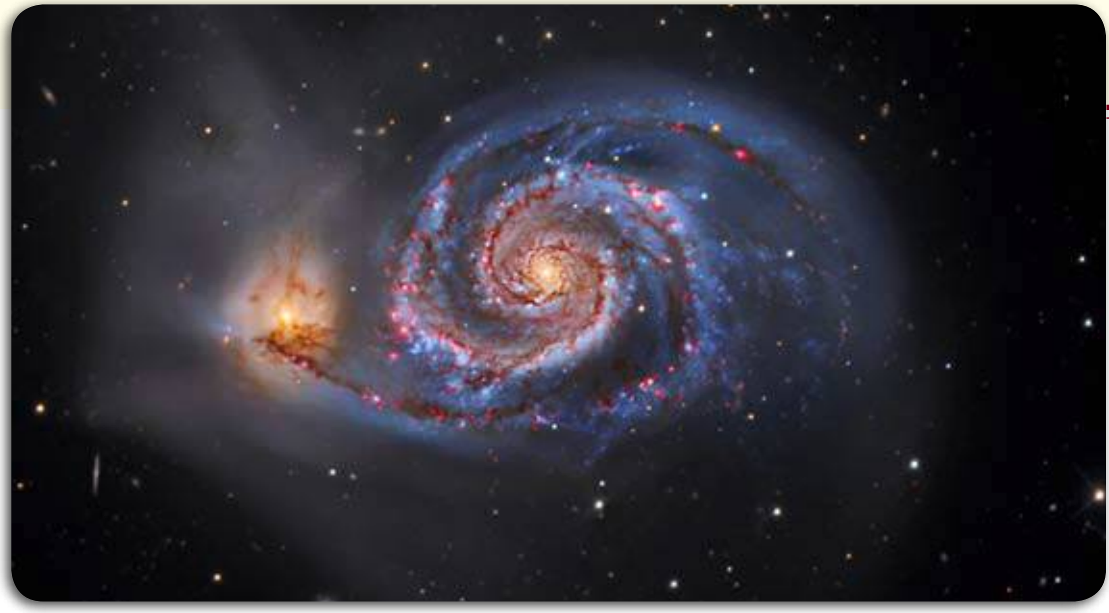
Best seen: **APRIL 14**

32 The Whirlpool Galaxy

Spiral galaxy in Canes Venatici

Whirlpool Galaxy statistics

Also known as: M51 and NGC 5194
Right ascension: 13h30m
Declination: 47°12'
Magnitude: 8.4
Apparent size: 11' by 7'
Distance: 37 million light-years
Visible: North of latitude 42° S.



THE WHIRLPOOL GALAXY (M51) in Canes Venatici lies one-quarter of the way between magnitude 1.8 Alkaid (Eta [η] Ursae Majoris) and magnitude 2.8 Cor Caroli (Alpha [α] Canum Venaticorum). Through a large scope, look for the edge-on spiral galaxy IC 4277 to the lower left of NGC 5195. TONY AND DAPHNE HALLAS

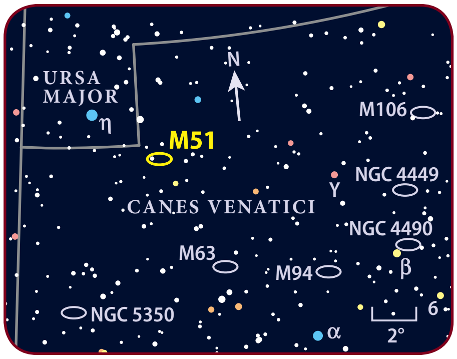
Even in a publication of the 100 most spectacular celestial objects, the Whirlpool Galaxy stands out. It won't disappoint you through a small telescope; see it through a large scope, however, and it will knock your socks off.

Charles Messier discovered the object that would become his catalog's 51st entry while observing a comet October 13, 1773. Pierre Méchain discovered the Whirlpool's smaller companion, NGC 5195, March 21, 1781.

This object's spiral structure first revealed itself through Lord Rosse's 6-foot reflector at Parsonstown, Ireland, in 1845. Rosse wrote of "Spiral convolutions; with successive increase of optical power, the structure has become more complicated. The connection of the companion with the greater nebula is not to be doubted; the most conspicuous of the spiral class."

NGC 5195 lies some distance behind the plane of M51's disk. Although photographs appear to show a connecting arm between the two galaxies, this is an illusion. Computer models indicate NGC 5195 passed close to the Whirlpool's disk some 70 million years ago and then plunged through its plane.

You'll see M51's spiral arms through 8-inch or larger telescopes. Through a 12-inch scope, they appear patchy and reveal much greater detail. Look for the thin, dark dust lanes that follow the arms' inner edges. Also, try to spot the apparent connecting arm between M51 and NGC 5195. Although M51 is larger, NGC 5195's core appears brighter. 100



THROUGH A TELESCOPE, YOU CAN separate M51 (NGC 5194) from its magnitude 9.6 companion NGC 5195. The two lie only 4.5' apart.

PAT BALFOUR/ADAM BLOCK/NOAO/AURA/NSF

Look for these celestial targets nearby:

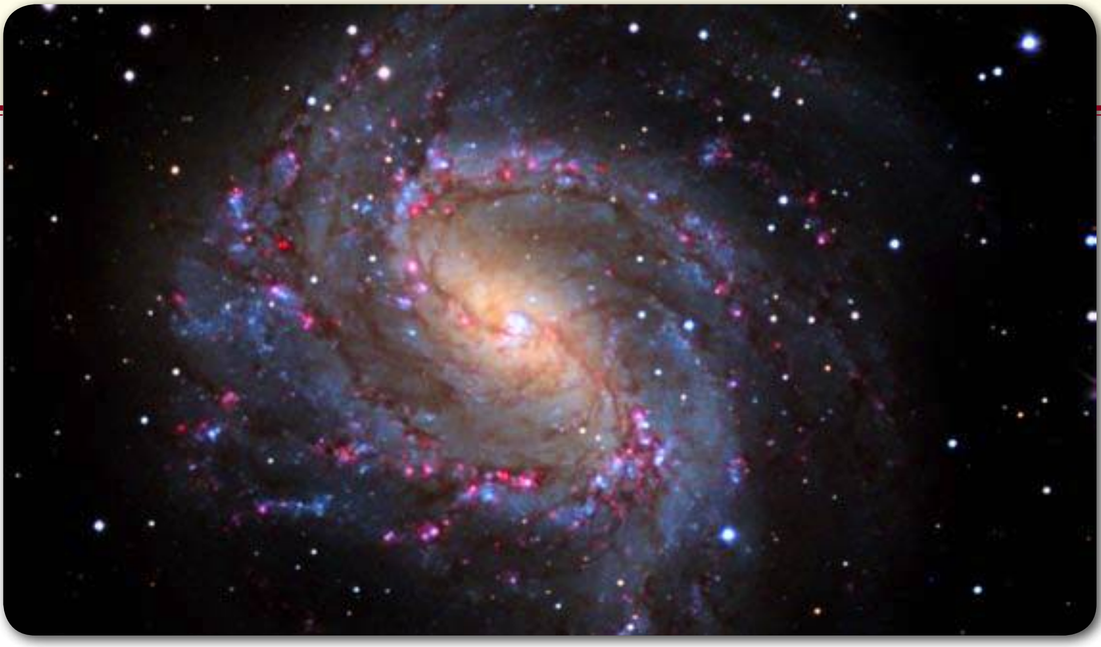
- ››› **M106,** a magnitude 8.3 spiral galaxy, lies 12° west.
- ››› **NGC 4800,** a magnitude 11.6 spiral galaxy, lies 6° west.
- ››› **NGC 5383,** a magnitude 11.5 spiral galaxy, lies 7.2° southeast.
- ››› **NGC 5676,** a magnitude 11.1 spiral galaxy, lies 10.7° east-northeast.

IF YOU LIKE THIS OBJECT, be sure to observe:
The Southern Whirlpool Galaxy (M83) — page 38 • M101 — page 39 • The Southern Pinwheel Galaxy (NGC 300) — page 78

Best seen: **APRIL 16**

33 The Southern Whirlpool Galaxy

Barred spiral galaxy in Hydra



THE SOUTHERN WHIRLPOOL GALAXY (M83) in Hydra has well-defined spiral arms that originate from a bar that includes the galaxy's nucleus. ALLAN COOK/ADAM BLOCK/NOAO/AURA/NSF

Southern Whirlpool Galaxy statistics

Also known as: M83 and NGC 5236

Right ascension: 13h37m

Declination: –29°52'

Magnitude: 7.5

Apparent size: 11'

Distance: 15 million light-years

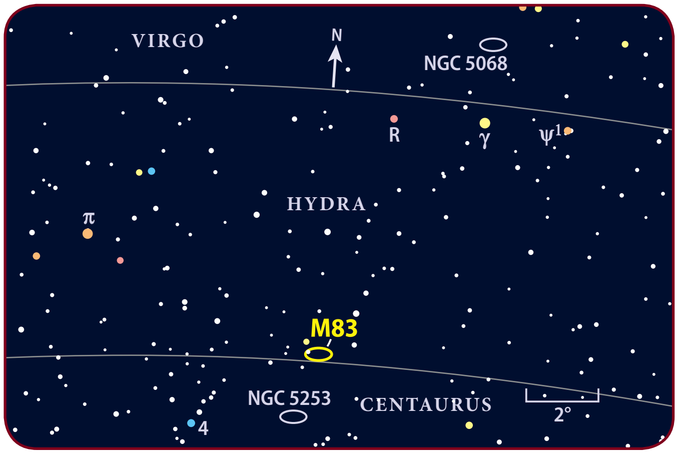
Visible: North of latitude 60° S.

Dubbing a galaxy the "Southern Whirlpool" puts a lot of pressure on it to perform visually. For M83, that's no problem. Some observers rate this galaxy the finest barred spiral visible to northern observers.

Nicolas Louis de Lacaille discovered M83 February 23, 1752. It was the third galaxy discovered. Only the Andromeda Galaxy (page 75) and its companion M32 preceded it. Charles Messier added it to his catalog March 18, 1781, although from Paris he didn't see it well: "It appears as a faint and even glow but it is difficult to see in the telescope as the least illumination of the micrometer wires makes it disappear."

M83 is a bright member of a collection of some 14 galaxies called the M83 group. The other notable object in this group is Centaurus A.

The Southern Whirlpool Galaxy appears nearly face-on, so you'll see its spiral structure through telescopes with apertures as small as 6 inches. The core is small and round, and the bar emanates from it to the northeast and southwest. Both spiral arms are easy to see, but the one that wraps southward from the bar's northeastern end shows up better. Through 12-inch and larger scopes, you'll see clusters of stars and star-forming regions along the arms. 100



M83 FINDS ITSELF in a bleak region of sky. The nearest reasonably bright star, 1 Centauri, shines at magnitude 4.2 and lies 3.7° south-southeast.

Look for these celestial targets nearby:

- ››› **M68,** a magnitude 7.3 globular cluster, lies 13° west.
- ››› **NGC 5068,** a magnitude 9.8 spiral galaxy, lies 9.7° north-northwest.
- ››› **NGC 5253,** a magnitude 10.1 spiral galaxy, lies 1.9° south-southeast.
- ››› **NGC 5694,** a magnitude 10.2 globular cluster, lies 14.2° east.

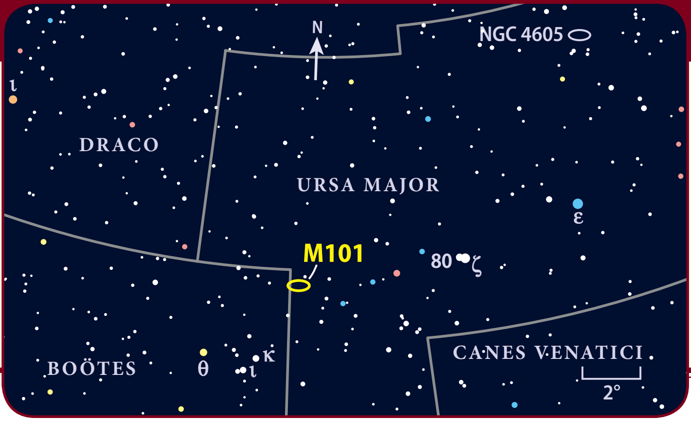
DANIEL VERSCHATSE

IF YOU LIKE THIS OBJECT, be sure to observe:
The Whirlpool Galaxy (M51) — page 37 • NGC 6946 — page 60 • NGC 1365 — page 86

Best seen: **APRIL 23**

34 M101

Spiral galaxy in Ursa Major



M101 lies less than 0.5° from the Boötes border, so use Theta (θ), Iota (ι), and Kappa (κ) Boötis to star-hop to its location.

Only one thing prevents spiral galaxy M101 from making every observer's top 10 list — its surface brightness. Covering slightly more area than the Full Moon, M101's light spreads out so much that only large amateur telescopes — those 12 inches in aperture and larger — do it justice.

That being said, M101 still represents one of the sky's "grand design" spiral galaxies — one with prominent and clearly defined spiral arms. The arms mostly or completely surround such galaxies. Only about 10 percent of all spiral galaxies fall into the grand-design category.

Pierre Méchain discovered M101 March 27, 1781. Before the 20th century, astronomers thought objects like M101 were made of gas. Admiral William H. Smyth, however, described M101 as if he lived 100 years later: "It is one of those globular nebulae that seem to be caused by a vast agglomeration of stars rather than by a mass of diffused, luminous matter … the paleness tells of its inconceivable distance."

From a dark site through a large scope, look for M101's multiple spiral arms. The core is concentrated but not starlike. Many star-forming regions and stellar associations lie along the spiral arms. Astronomers have assigned seven of these objects their own NGC numbers.

Look 6' southwest of M101's core for NGC 5447, which is the most prominent. Use a nebula filter to tell the difference between star-forming regions and associations. The filter will dim the stars within the associations, but not the nebular gas of the star-forming regions.

M101 statistics

Also known as: NGC 5457

Right ascension: 14h03m

Declination: 54°21'

Magnitude: 7.9

Apparent size: 22'

Distance: 27 million light-years

Visible: North of latitude 35° S.

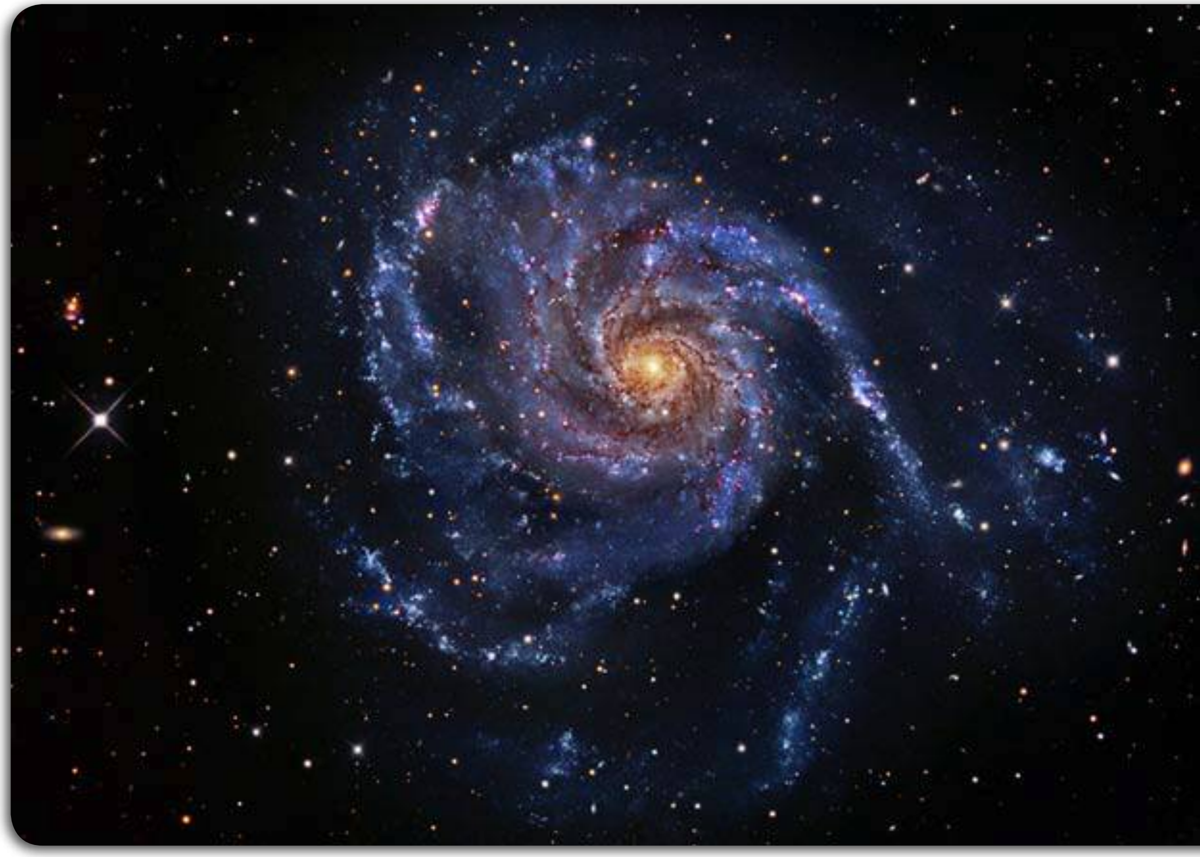
Look for these celestial targets nearby:

››› **M102,** a magnitude 10.1 spiral galaxy, lies 13.1° northwest.

››› **NGC 4605,** a magnitude 9.9 spiral galaxy, lies 9.2° east-northeast.

››› **NGC 5907,** a magnitude 10.4 spiral galaxy, lies 10.5° east-northeast.

››› **NGC 5905,** a magnitude 12.1 spiral galaxy, lies 10.4° east-northeast.



SPIRAL GALAXY M101 IN URSA MAJOR SPINS THROUGH SPACE like a cosmic propeller. Use a 10-inch or larger scope for detailed observing because M101 has a low surface brightness. TONY AND DAPHNE HALLAS

IF YOU LIKE THIS OBJECT, be sure to observe:
The Sunflower Galaxy (M63) — page 34 • The Pinwheel Galaxy (M33) — page 80 • Cetus A (M77) — page 84

BEST SEEN: **MAY 29**

35 M4

Globular cluster in Scorpius

M4 IN SCORPIUS is the sky's sixth-brightest globular cluster. It outshines the more-often-observed M13 in Hercules by nearly half a magnitude. GEORGE SEITZ/ADAM BLOCK/NOAO/AURA/NSF

Globular cluster M4 ranks as one of the lucky objects on our list because it lies near a 1st-magnitude star that serves as a guide to it. Just center Antares (Alpha [α] Scorpii) in your field of view, and M4 lies to its west.

Swiss astronomer Jean-Philippe Loys de Cheseaux (1718–1751) discovered M4 in 1746. He described it as, "Close to Antares … It is white, round and smaller than the preceding ones. I do not think it has been found before." Messier, who added it to his catalog May 8, 1764, was first to resolve it into a cluster of stars.

Astronomers classify M4 as a loose globular cluster of class IX. Globulars fall into classifications designated I to XII. A globular with a classification of I has the highest stellar density at its core. XII represents a homogenous globular with no increase in star concentration toward the center.

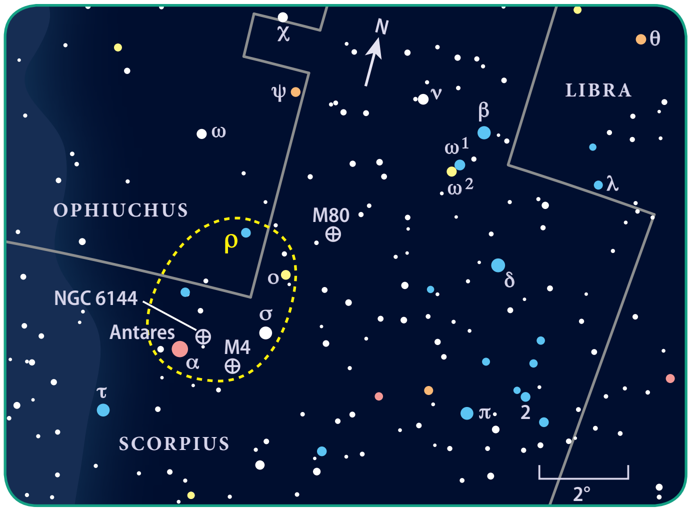
M4 statistics

Also known as: NGC 6121
Right ascension: 16h24m
Declination: –26°32'
Magnitude: 5.4
Apparent size: 36'
Distance: 7,200 light-years
Visible: South of latitude 63° N.

BEST SEEN: **MAY 30**

36 The Rho Ophiuchi region

Nebulae in Ophiuchus and Scorpius



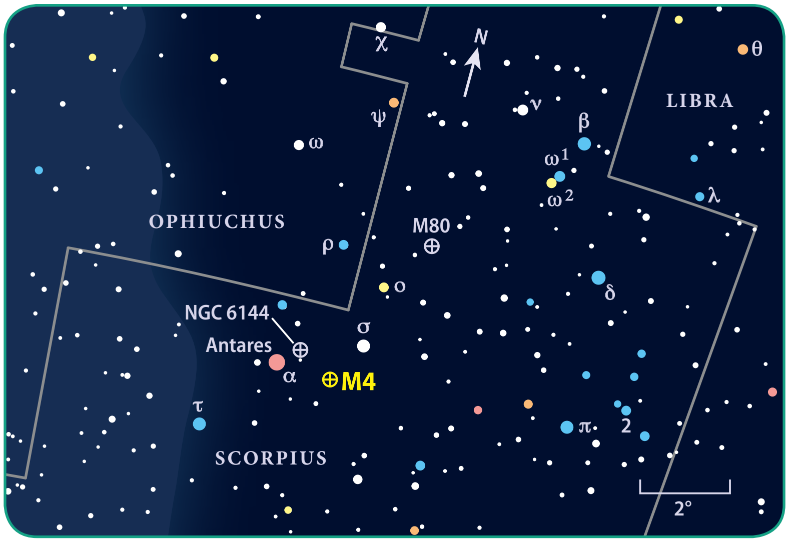
THE LEAST IMPRESSIVE OBJECT in the Rho Ophiuchi region is the magnitude 4.6 star that gives the area its name.

THE RHO OPHIUCHI REGION is a colorful area of star formation, with emission and reflection nebulae, within 5° of Rho (ρ) Ophiuchi. TONY AND DAPHNE HALLAS

Only two of our 100 wonders represent regions of the sky — this one, and the area around Gamma Cygni (page 59).

Astronomers named this region for the magnitude 4.6 star Rho (ρ) Ophiuchi. To begin searching this area, center on brilliant Antares

IF YOU LIKE THIS OBJECT, be sure to observe:
The Hercules Cluster (M13) — page 42 • M22 — page 49 • M15 — page 65



M4 is one of the easiest deep-sky objects to find. Just locate magnitude 0.9 Antares (Alpha [α] Scorpii), and move 1.3° west.

Point a 6-inch telescope toward M4, and you'll see dozens of stars scattered loosely across its diameter. A prominent chain of stars runs north-south through the cluster's center. A 12-inch or larger scope at 200x will reveal 200 stars between 11th and 15th magnitudes. At this magnification, other star patterns mask the central star chain. Amateur scopes can resolve all but the central 10 percent of this cluster.

Look for these celestial targets nearby:

DANIEL VERSCHATSE

- ››› **M5,** a magnitude 5.7 globular cluster, lies 32.6° north-northwest.
- ››› **M19,** a magnitude 6.8 globular cluster, lies 8.7° east.
- ››› **M62,** a magnitude 6.4 globular cluster, lies 9° east-southeast.
- ››› **M80,** a magnitude 7.3 globular cluster, lies 3.8° north-northwest.

Rho Ophiuchi region statistics

Objects in this region include: NGC 6144, IC 4604, IC 4606, Sharpless 2–9, and B44
Right ascension: 16h27m
Declination: –25°30'
Magnitude: —
Apparent size: 4°
Distance: 500 light-years
Visible: South of latitude 64° N.

(Alpha [α] Scorpii). Stifle your natural urge to observe globular clusters M4 and NGC 6144 — you're in this region to hunt nebulae.

Start by scanning the area above (north) and to the left (east) of Antares through binoculars or the lowest-power, widest field of view your telescope will allow. Look for the absence of stars caused by dark nebula Barnard 44 (B44). This dark, sharply defined lane starts at 22 Scorpii and runs eastward an incredible 6.5°, ending at 24 Ophiuchi.

Rho Ophiuchi is a double star, with yellow components of magnitudes 5.1 and 5.7 separated by 3". Reflection nebula IC 4604 surrounds Rho. Look for the nebula's ribbed structure. A nebula filter won't help because such filters block the blue light from reflection nebulae. Some observers report good results with a light- or medium-blue filter.

Head back to 22 Sco, and examine the nebula IC 4605 around it. Because IC 4605 is an emission nebula, it will respond well to a nebula filter. American astronomer Edward Emerson Barnard (1857–1923), who cataloged many of the sky's dark nebulae, described this nebulosity: "The star 22 Scorpii strikingly resembles a human eye, the lids being formed by two strips of nebulosity, one above it and one below."

Look for these celestial targets nearby:

ERICA AND DAN SIMPSON/ADAM BLOCK/NOAO/AURA/NSF

- ››› **M9,** a magnitude 7.8 globular cluster, lies 13.4° east-northeast.
- ››› **M107,** a magnitude 7.8 globular cluster, lies 10.5° north.
- ››› **NGC 6293,** a magnitude 8.3 globular cluster, lies 10.6° east-southeast.
- ››› **NGC 6369,** a magnitude 11.4 planetary nebula, lies 14.6° east.

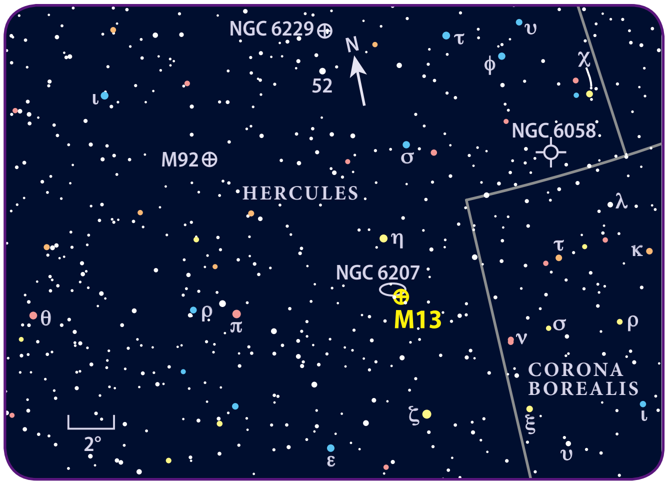
IF YOU LIKE THIS OBJECT, be sure to observe:
The North America Nebula (NGC 7000) — page 62 • The Flame Nebula (NGC 2024) — page 92 • The Cone Nebula (NGC 2264) — page 98

BEST SEEN: **JUNE 2**

37 The Hercules Cluster

Globular cluster in Hercules

THE HERCULES CLUSTER (M13) lies one-third of the way from Eta (η) to Zeta (ζ) Herculis. At magnitude 5.8, it's a naked-eye object from a dark site. R. JAY GABANY



WHEN M13 is your target, don't forget to observe spiral galaxy NGC 6207. This magnitude 11.4 galaxy lies only 0.5° northeast of M13.

Late spring ushers in new constellations and a wonder often referred to as the "Great" globular cluster. Of the sky's 10 brightest globulars, only two — M5 (seventh brightest) and M13 (eighth brightest) lie in the northern sky. M13, however, sits nearly 35° higher than M5 for northern observers, so it's the brightest globular most amateur astronomers are familiar with.

English astronomer Edmond Halley (1656–1742) discovered this object in 1714. Of it, he said, "This is but a little patch but it shows itself to the naked eye when the sky is serene and the Moon is absent." Messier cataloged it June 1, 1764. The first line of his descriptions seems almost comical now: "A nebula which I am sure contains no star."

Under a dark sky, you'll spot M13 easily as a fuzzy "star" two-thirds of the way from Zeta (ζ) to Eta (η) Herculis. Containing stars as bright as 12th magnitude, you'll fully resolve this globular through telescopes with apertures as small as 3 inches.

Hercules Cluster statistics

Also known as: M13 and NGC 6205
Right ascension: 16h42m
Declination: 36°28'
Magnitude: 5.8
Apparent size: 20'
Distance: 25,000 light-years
Visible: North of latitude 53° S.

Through 8-inch and larger scopes, you'll see hundreds of stars, some appearing as streamers emanating from the edge. Crank up your magnification to 200x or more and try to see a small Y-shaped region of three dark lanes near M13's center. Amateur astronomers have dubbed this feature the "propeller."

The cluster fills most telescopes' field of view. The core is so bright that you may miss detail because of it. Even around M13's edge, resolved stars appear against a background glow of thousands of unseen stars.

Look for these celestial targets nearby:

››› **M92,** a magnitude 6.5 globular cluster, lies 9.5° northeast.

››› **NGC 6058,** a magnitude 12.9 planetary nebula, lies 8.4° west-northwest.

››› **NGC 6207,** a magnitude 11.4 spiral galaxy, lies 0.5° northeast.

››› **NGC 6210,** a magnitude 8.8 planetary nebula, lies 12.7° south.

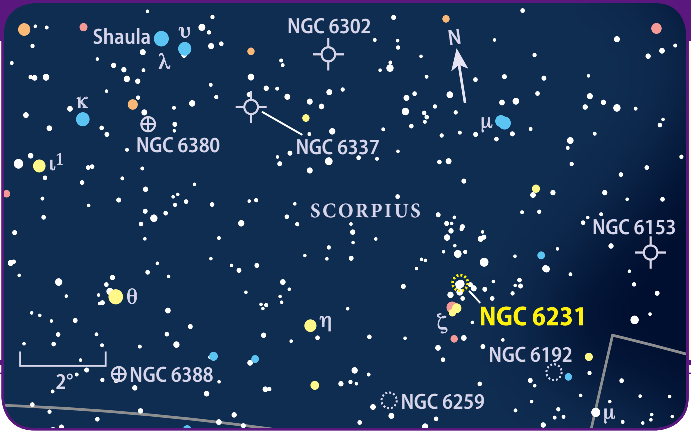
CHRIS SCHUR

IF YOU LIKE THIS OBJECT, be sure to observe:
Omega Centauri (NGC 5139) — page 36 • M4 — page 40 • 47 Tucanae (NGC 104) — page 74

BEST SEEN: **JUNE 5**

38 The Northern Jewel Box

Open cluster in Scorpius



NGC 6231 AT THE SOUTHERN END OF SCORPIUS forms part of the "body" of a region called the False Comet. Nearby Zeta (ζ) Scorpii is the comet's head. Use binoculars for the best view.

At the southernmost reaches of Scorpius, a stellar "comet" shines brightly. The head of this asterism, known as the False Comet, is the spectacular open cluster NGC 6231.

Unlike the Jewel Box Cluster (page 32), which it outshines by 1.6 magnitudes, NGC 6231's stars all appear bluish-white. The Northern Jewel Box ranks as the sky's sixth-brightest open star cluster.

Australian chemist Ernst Johannes Hartung (1893–1979) wrote about NGC 6231: "This cluster produces the impression of a handful of glittering diamonds displayed on black velvet." Hartung was the author of the popular *Astronomical Objects for Southern Telescopes*, which has been reprinted and updated since it appeared in 1968.

Giovanni Batista Hodierna discovered NGC 6231 and included it on his list of 40 nebulous objects, printed in 1654. This object shines so brightly, however, that earlier skywatchers certainly noticed it. He was, however, the first to catalog it.

The region from Zeta (ζ) to Mu (μ) Scorpii contains a group of hot, young stars called the Scorpius OB1 association. Twenty member stars shine brighter than 9th magnitude, but their real brightnesses are astounding — the brightest stars of NGC 6231 outshine the Sun by 60,000 times.

Through a 4-inch telescope from a dark site, you'll see more than 100 stars. Particularly striking is the knot of half a dozen bright stars at the cluster's center. The cluster is so bright that it stands out even from the surrounding Milky Way star field. It has sharply defined eastern and southwestern edges. 100

Look for these celestial targets nearby:

››› **NGC 6072,** a magnitude 11.7 planetary nebula, lies 9.8° west-northwest.

››› **NGC 6192,** a magnitude 8.5 open cluster, lies 3° west-southwest.

››› **NGC 6193,** a magnitude 5.2 open cluster, lies 7.3° south-southwest.

››› **NGC 6259,** a magnitude 8.0 open cluster, lies 3.1° south-southeast.

Northern Jewel Box statistics

Also known as: NGC 6231 and Caldwell 76

Right ascension: 16h54m

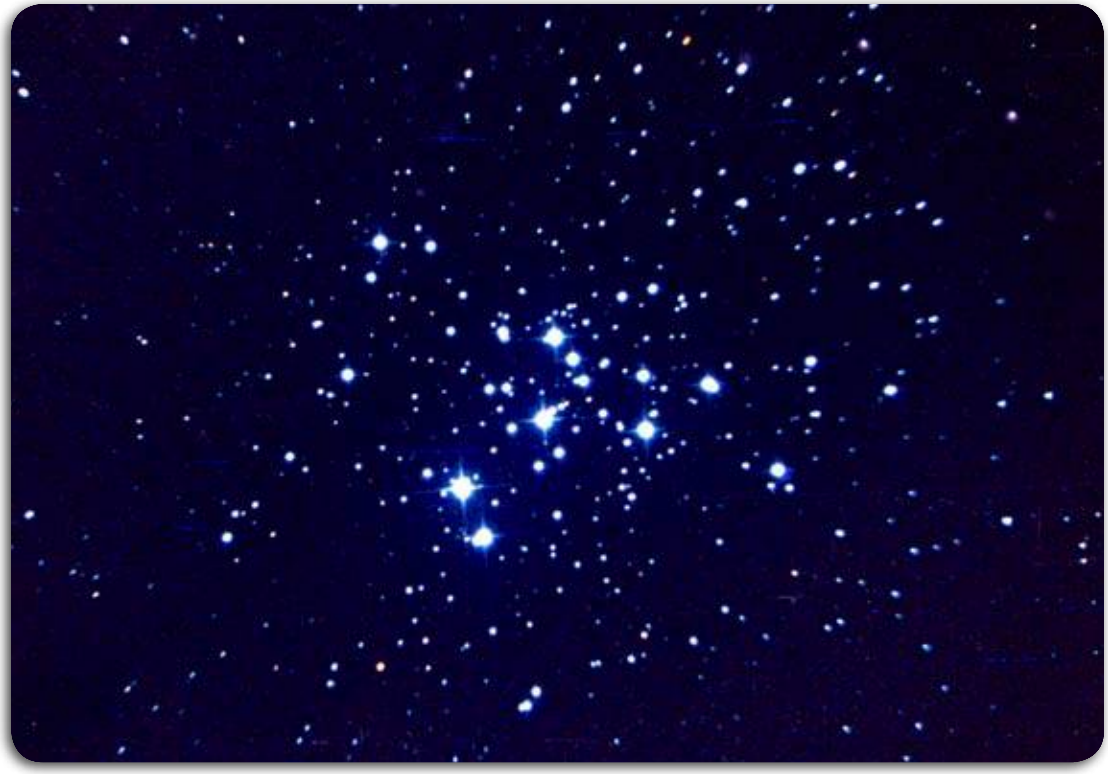
Declination: –41°50'

Magnitude: 2.6

Apparent size: 14'

Distance: 4,000 light-years

Visible: South of latitude 48° N.



THE NORTHERN JEWEL BOX (NGC 6231) lies at the southern end of the Scorpius OB1 association, a huge group of hot stars. At magnitude 2.6, NGC 6231 is the sky's sixth-brightest open star cluster. JACK MARLING

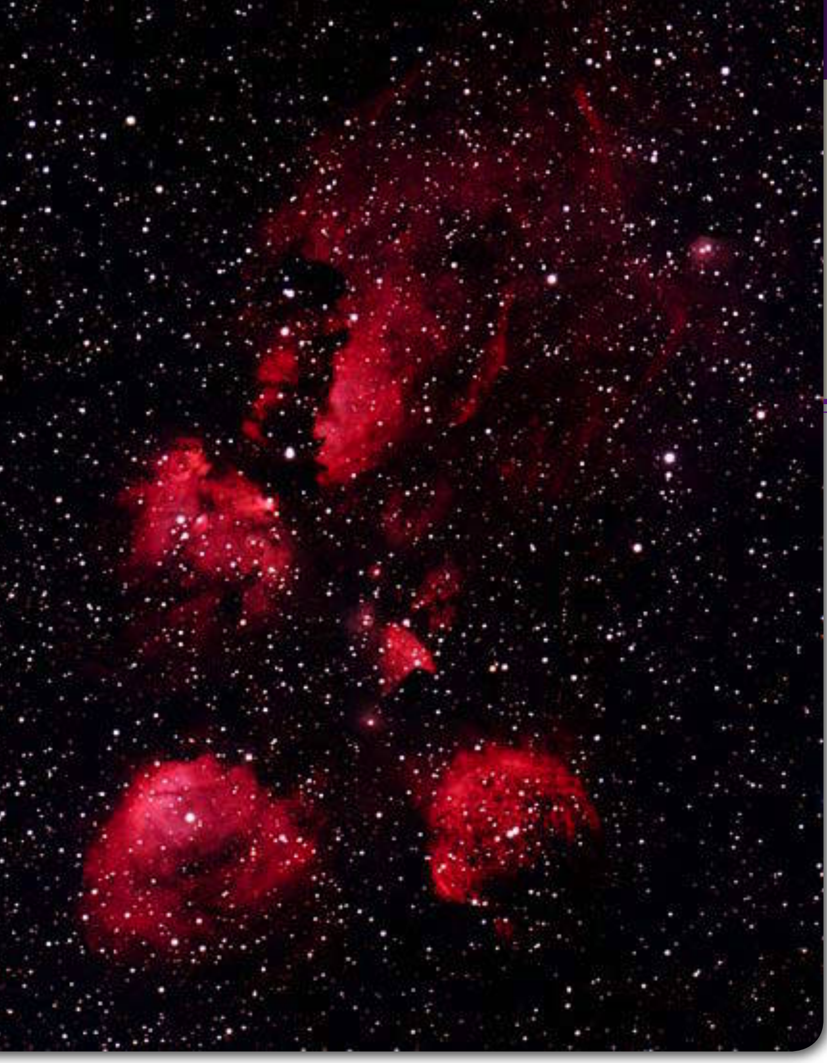
IF YOU LIKE THIS OBJECT, be sure to observe:

The Tau CMa Cluster (NGC 2362) — page 8 • Ptolemy's Cluster (M7) — page 46 • The Wild Duck Cluster (M11) — page 51

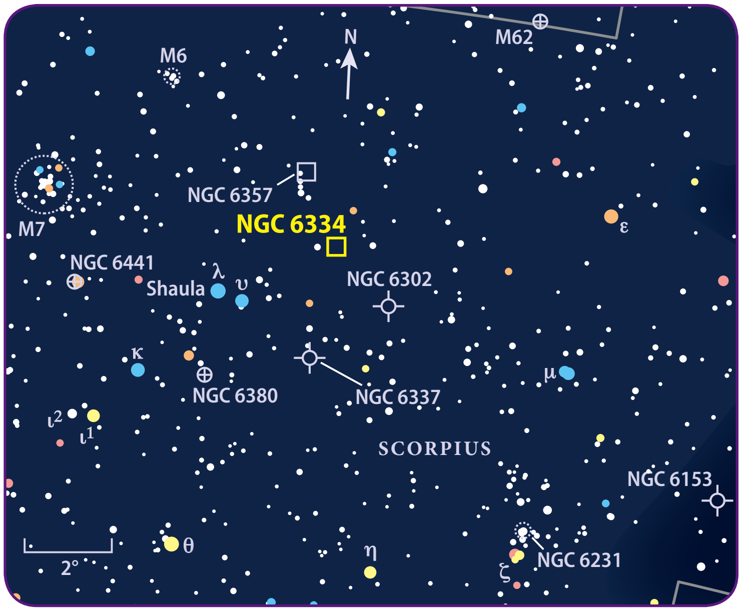
BEST SEEN: **JUNE 12**

39 The Cat's Paw Nebula

Emission nebula in Scorpius



THE CAT'S PAW NEBULA (NGC 6334) in Scorpius contains a group of five nebulous patches. This star-forming region resembles a feline's paw print. Use an OIII filter for best results. DON WESTERGREN



START AT SHAULA (Lambda [λ] Scorpii), then move 3° west-northwest to NGC 6334. Don't confuse NGC 6334 with the nearby Lobster Nebula (see page 46), which appears fainter.

Some named deep-sky objects look exactly like their namesakes. The Dumbbell Nebula (page 57) and the North America Nebula (page 62) come to mind. Observers add one more — the Cat's Paw Nebula.

Sir John Herschel discovered NGC 6334 June 7, 1837, from the Cape of Good Hope in South Africa. He labeled it "h 3678" in his 1847 catalog. More recently, Australian astronomer Colin S. Gum gave this nebula six entries (Gum 61, 62, 63, 64a, 64b, and 64c) in his 1955 catalog, the first major survey of southern-sky ionized hydrogen (HII) regions.

The Cat's Paw Nebula ranks among the Milky Way's largest star-forming regions. It comprises five individual nebulous patches in a roughly circular area. The brightest, which measures 6' across and contains a magnitude 9 star, lies on the southeastern end of the complex.

Because this object is larger than the Full Moon, you'll need a wide-field telescope/eyepiece combination to view it all. Or, crank up the power a bit, add a nebula filter, and view each of the five areas separately.

Cat's Paw Nebula statistics

Also known as: NGC 6334
Right ascension: 17h20m
Declination: –35°43'
Magnitude: —
Apparent size: 40'
Distance: 1,700 light-years
Visible: South of latitude 54° N.

PAUL AND DANIEL KOBLAS/ADAM BLOCK/NOAO/AURA/NSF

Look for these celestial targets nearby:

››› **NGC 6242,** a magnitude 6.4 open cluster, lies 6.1° southwest.

››› **The Bug Nebula (NGC 6302),** a magnitude 9.6 planetary nebula, lies 1.8° southwest.

››› **The Cheerio Nebula (NGC 6337),** a magnitude 12.3 planetary nebula, lies 2.7° south.

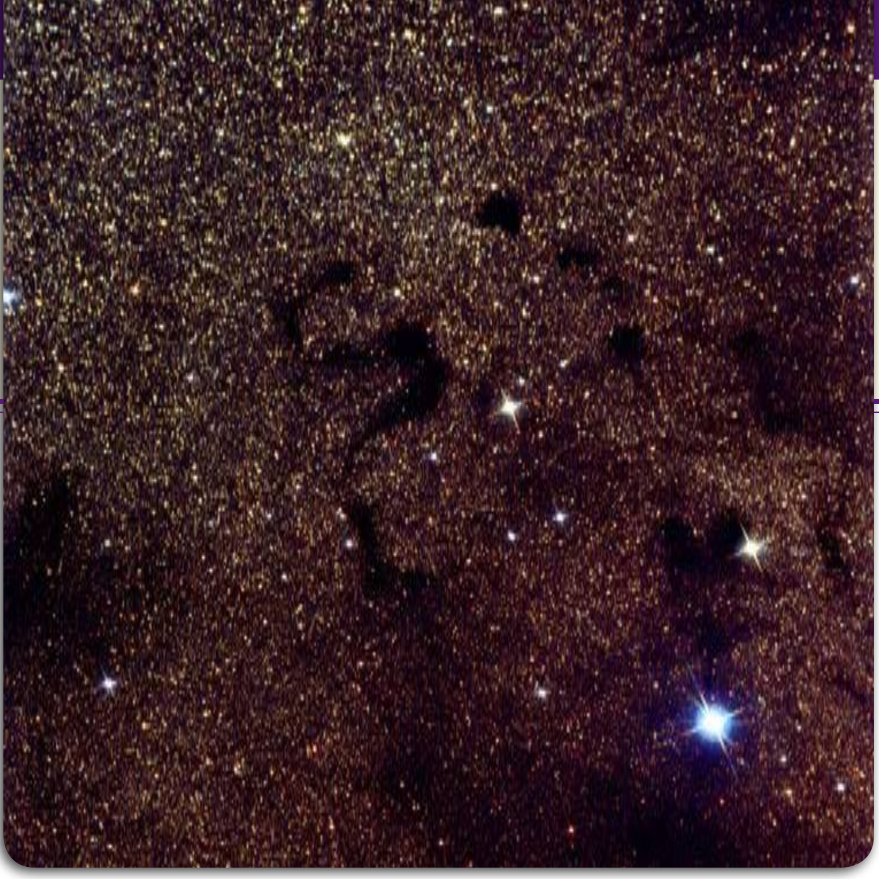
››› **Bochum 13,** a magnitude 7.2 open cluster, lies 0.7° west-northwest.

IF YOU LIKE THIS OBJECT, be sure to observe:

The Eight-burst Nebula (NGC 3132) — page 16 • The Trifid Nebula (M20) — page 48 • The Cocoon Nebula (IC 5146) — page 67

40 The Snake Nebula

Dark nebula in Ophiuchus



THE SNAKE NEBULA (B72) lies at the center of a maelstrom of dark nebulae in the constellation Ophiuchus. TOM McQUILLAN/ADAM BLOCK/NOAO/AURA/NSF

The Milky Way, which contains hundreds of billions of stars, also contains areas of great darkness. Pre-20th-century astronomers believed these starless voids were literal holes in the sky. In Volume 38 of *The Astrophysical Journal* (1913), American astronomer Edward Emerson Barnard published "Dark Regions in the Sky Suggesting an Obscuration of Light."

Barnard was the first astronomer to consider the possibility that dark nebulae were clouds of matter — mostly dust, and not voids.

He wrote, "The so-called 'black holes' in the Milky Way are of very great interest. Some of them are so definite that, possibly, they suggest not vacancies, but rather some kind of obscuring body lying in the Milky Way, or between us and it, which cuts out the light from the stars."

Barnard cataloged 349 dark nebulae, of which the Snake Nebula was the 74th entry. It carries the designation B72, however, because Barnard added two "extra" numbers to his list before B72: B44a and B67a.

Cold molecular gas and dust, primarily carbon soot, make up dark nebulae. Such clouds absorb light from nearby stars but do not reradiate it as visible light. Rather, molecular clouds such as the Snake Nebula give off infrared light.

Over a period of millions of years, gravity contracts dark nebulae to a pressure and temperature at which stars can begin fusing hydrogen in their cores. When stars begin to form within a dark nebula, it begins emitting visible light.

You'll get your best views of the Snake Nebula through binoculars or a wide-field telescope/eyepiece combination. Filters don't help because they dim the surrounding stars, reducing the contrast between them and the dark nebula.

Look for these celestial targets nearby:

››› **NGC 6284,** a magnitude 8.9 globular cluster, lies 4.5° west-southwest.

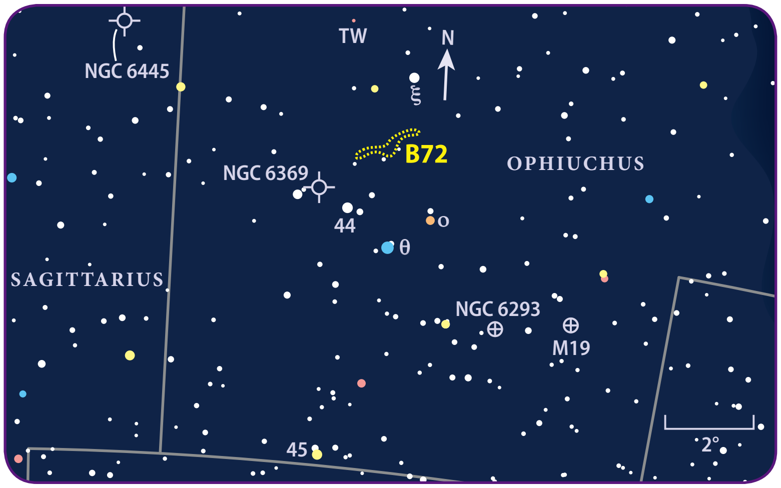
››› **NGC 6287,** a magnitude 9.3 globular cluster, lies 4.4° west.

››› **NGC 6325,** a magnitude 10.2 globular cluster, lies 1.3° west.

››› **NGC 6342,** a magnitude 9.5 globular cluster, lies 4.1° north.

Snake Nebula statistics

Also known as: Barnard 72 (B72)
Right ascension: 17h23m
Declination: –23°34'
Magnitude: —
Apparent size: 4'
Distance: 650 light-years
Visible: South of latitude 66° N.



IN OPHIUCHUS, the Snake Nebula stands out against the Milky Way's diffuse background. To find it, use binoculars to search the area between Xi (ξ) and 44 Scorpii.

IF YOU LIKE THIS OBJECT, be sure to observe:
The Ink Spot (B86) — page 48 • IC 1396 — page 66 • The Horsehead Nebula (B33) — page 92

BEST SEEN: **JUNE 13**

41 The Lobster Nebula

Emission nebula in Scorpius

Lobster Nebula statistics

Also known as: the War and Peace Nebula and NGC 6357

Right ascension: 17h24m

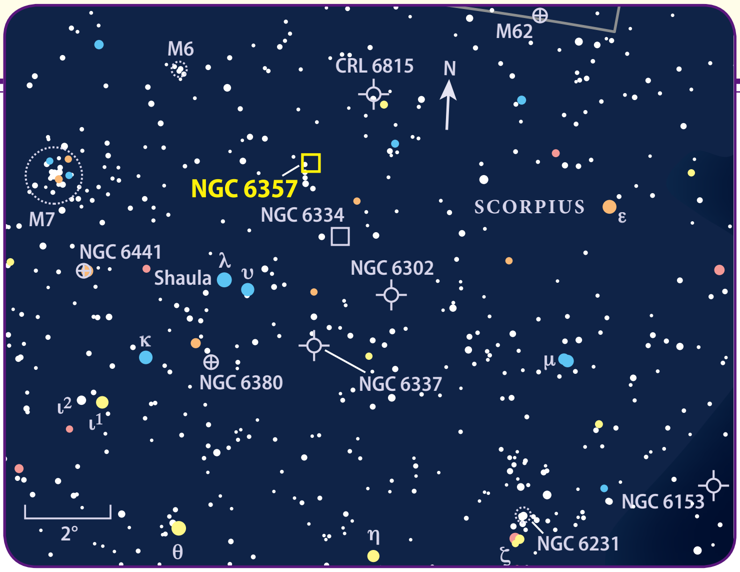
Declination: –34°20'

Magnitude: —

Apparent size: 50'

Distance: 1,700 light-years

Visible: South of latitude 55° N.



EMISSION NEBULA NGC 6357 contains a small star cluster, Pismis 24. Several of this cluster's immense stars exceed 100 solar-masses.

When you've finished looking at the Cat's Paw Nebula (page 44), you'll find an equally impressive star-forming region just 2° to the north-northeast.

Sir John Herschel discovered and cataloged the Lobster Nebula in 1837, during his 4-year stay at the Cape of Good Hope in South Africa.

NGC 6357 surrounds the magnitude 9.6 open cluster Pismis 24. Some of this cluster's bright blue stars are among the most massive ever discovered. For example, astronomers using the Hubble Space Telescope discovered a double star of 100 solar-masses.

The cluster's stars give off intense ultraviolet radiation. Energetic photons strike hydrogen atoms, exciting them. Their electrons move to higher energy levels, but the gas' atoms cannot hold

BEST SEEN: **JUNE 20**

42 Ptolemy's Cluster

Open cluster in Scorpius

Ptolemy's Cluster statistics

Also known as: M7 and NGC 6475

Right ascension: 17h54m

Declination: –34°47'

Magnitude: 3.3

Apparent size: 75'

Distance: 950 light-years

Visible: South of latitude 55° N.

Scorpius offers several deep-sky treats visible with the unaided eye. One of its standout deep-sky objects — open cluster M7 — lies 4.7° east-northeast of the two bright stars that mark the Scorpion's stinger, Lambda (λ) and Upsilon (υ) Scorpii. You'll spot M7 easily from any reasonably dark site.

Greek philosopher Ptolemy (c. 90–168) mentioned M7 around 130, describing it as a "Nebula following the sting of Scorpius." Messier added it to his catalog

PTOLEMY'S CLUSTER (M7) in Scorpius lies in the direction of the Milky Way's center. At magnitude 3.3, this cluster stands out well, especially through binoculars. ALLAN COOK/ADAM BLOCK/NOAO/AURA/NSF

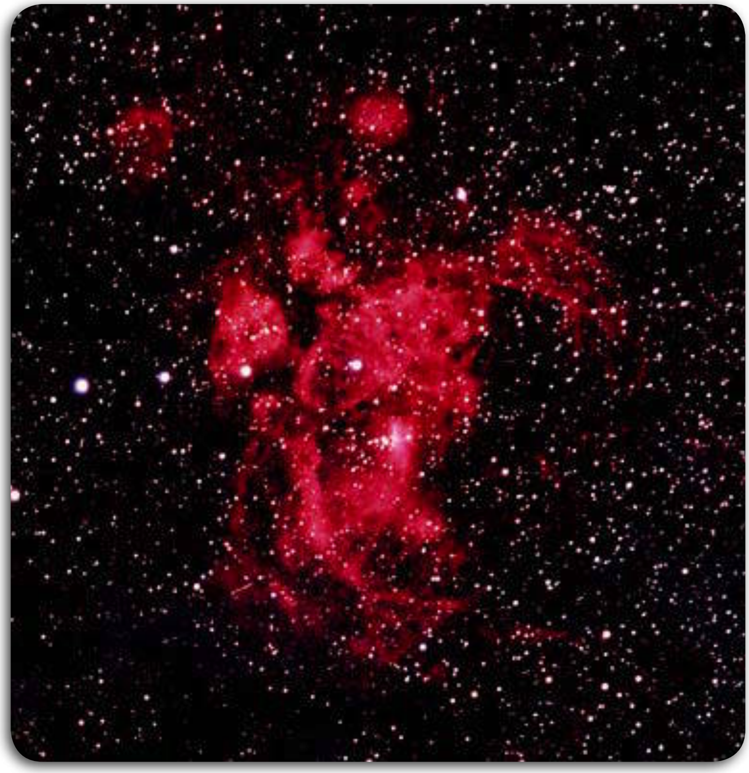
IF YOU LIKE THIS OBJECT, be sure to observe:
The Eta Carinae Nebula (NGC 3372) — page 19 • NGC 6559 — page 49 • The Gamma Cygni Region — page 59

the excess energy for long. When the electrons return to their normal (unexcited) state, rather than give off ultraviolet radiation, they emit light with a reddish hue.

Although NGC 6357's apparent size — as measured on images — exceeds that of the Full Moon, through amateur telescopes you'll see only one-tenth of its extent.

The nebula's brightest region lies west of its center. Note the four 7th-magnitude stars in a line. The northernmost lies atop NGC 6357's center. Use a nebula filter to improve the view.

When you insert a nebula filter — such as an Oxygen III (OIII) — note how the stars dim. This effect helps the nebula appear brighter. The nebula's brightness, however, doesn't change. What the filter did was increase the object's contrast compared to the background sky. The net effect makes the Lobster Nebula easier to see.



THE LOBSTER NEBULA **(NGC 6357) in Scorpius lies less than 2° north-northeast of the Cat's Paw Nebula (see page 44).** GEORGE GREANEY

Look for these celestial targets nearby:

- ››› **M62,** a magnitude 6.4 globular cluster, lies 6.4° northwest.
- ››› **NGC 6396,** a magnitude 8.5 open cluster, lies 2.8° east-southeast.
- ››› **Antalova 2,** a magnitude 8.8 open cluster, lies 2° north-northeast.
- ››› **Collinder 333,** a magnitude 9.8 open cluster, lies 1.4° east.

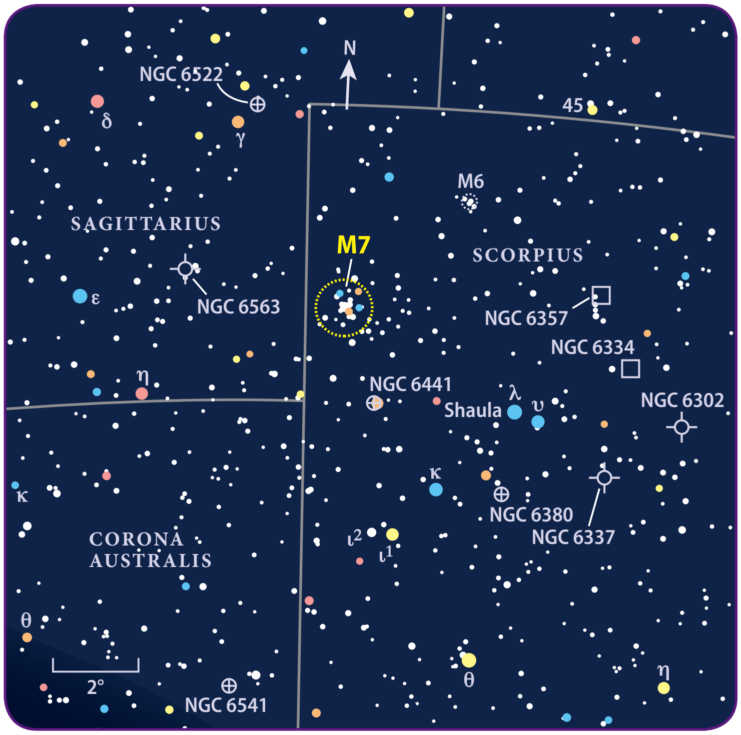
May 23, 1764, writing, "Star cluster more considerable than the preceding [M6]; this cluster appears to the naked eye like a nebulosity." M7 is the southernmost object in Messier's catalog. If you live above latitude 55° north, M7 lies below the horizon.

Ptolemy's Cluster is large enough that 4 Full Moons side by side could fit within its borders. Because it is so big, you'll need to use a low-magnification eyepiece to observe the entire cluster at once. When you do, notice how the background richness of the Milky Way's myriad faint stars enhance the view.

Alternately, you can crank up the magnification and look for double stars, patterns the cluster's stars form, or gaps between lines or arcs of stars. Through 10x50 binoculars, you'll count 50 stars in M7. Double the aperture (to a 4-inch telescope), and you'll double the number of stars you see.

Look for these celestial targets nearby:

- ››› **M6,** a magnitude 4.2 open cluster, lies 3.8° northwest.
- ››› **NGC 6416,** a magnitude 5.7 open cluster, lies 3° northwest.
- ››› **NGC 6453,** a magnitude 10.2 globular cluster, lies 0.6° west-northwest.
- ››› **NGC 6569,** a magnitude 8.4 globular cluster, lies 5° northeast.



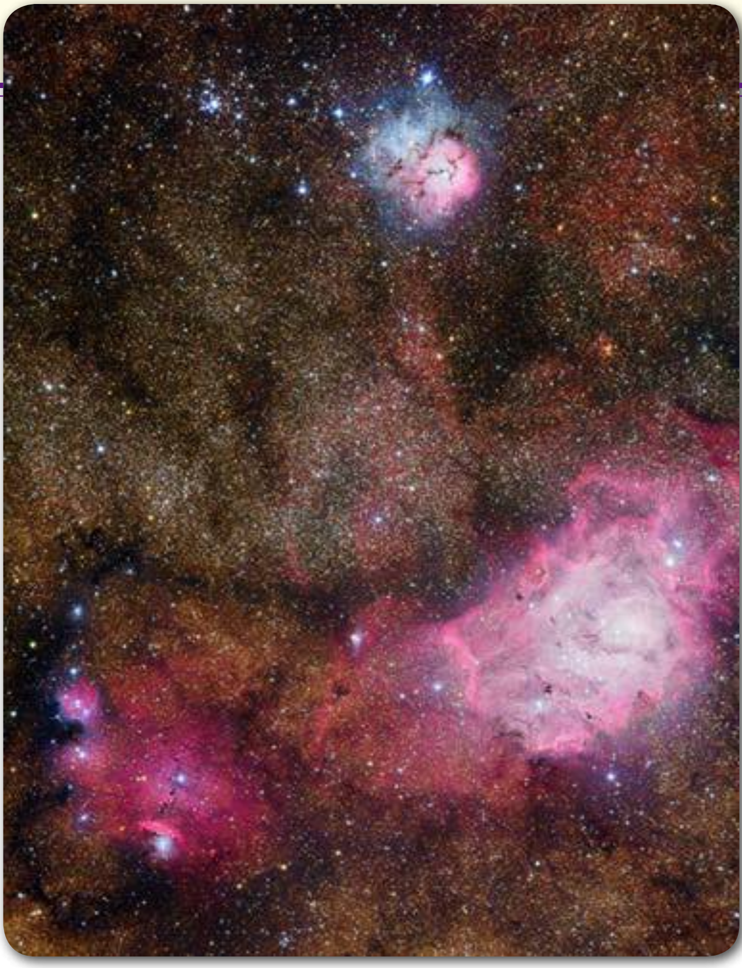
M7 **is the most southerly Messier object. From Canada or the northern United States, you'll need an unobstructed southern horizon to see it.**

IF YOU LIKE THIS OBJECT, be sure to observe:
M41 — page 6 • The Jewel Box Cluster (NGC 4755) — page 32 • The Double Cluster (NGC 869/884) — page 81

BEST SEEN: **JUNE 21**

43-49 The Milky Way's heart

Various objects in Sagittarius

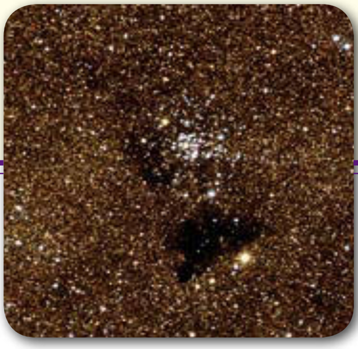


SAGITTARIUS HOLDS many treasures, but a certain area boasts three of the sky's wonders: the Lagoon Nebula (M8), lower right; the Trifid Nebula (M8), upper center; and NGC 6559, left. DANIEL VERSCHATSE

When you look toward Sagittarius from a dark site, you can tell a lot's going on. The Milky Way appears thick with both bright and dark regions. Through binoculars, this constellation sparkles with clusters and brilliant star-forming regions. In addition, the Milky Way's center lies in this direction.

This region's seven sky wonders lie in a swath of sky 8.3° wide and 14° high — only slightly larger than your fist held at arm's length. Moving from west to east (in order of increasing right ascension), we begin our tour with the **Trifid Nebula** (M20), an object Messier discovered June 5, 1764.

The Trifid Nebula owes its common name to three dust lanes that converge in front of the nebulosity. Look for a nice triple-star system just west of center. These three stars, and two more, provide the ultraviolet radiation that causes M20 to glow. On the Trifid's northern edge sits a reflection nebula, shown as blue in photos.



THE INK SPOT (B86) in Sagittarius is easy to spot through binoculars as a dark triangular patch. The tight grouping of stars above B86 is the magnitude 7.6 open star cluster NGC 6520. DANIEL C. GOOD

Next, move to a dark nebula called the **Ink Spot**, also known as Barnard 86 (B86). To target B86, just aim for NGC 6520, a nearby star cluster. Together, these objects present a wonderful contrast. Through an 8-inch telescope, you'll see about 30 stellar members of NGC 6520 against a bright background of distant stars.

No such background exists for B86. Its starless, irregular form stands out against myriad faint stars. Look for the orange magnitude 7 star on B86's western edge — a nice complement to the scene.

Only 1.4° south-southeast of M20 lies the magnificent **Lagoon**

Statistics

Object:	The Trifid Nebula	The Ink Spot	The Lagoon Nebula	NGC 6559	The Eagle Nebula	The Omega Nebula	M22
Also known as:	M20, NGC 6514	B86, LDN 93	M8, NGC 6523	LBN 28	M16, NGC 6611	M17, NGC 6618	NGC 6656
Right ascension:	18h02m	18h03m	18h04m	18h10m	18h19m	18h20m	18h36m
Declination:	–23°01'	–27°52'	–24°23'	–24°00'	–13°49'	–16°11'	–23°54'
Magnitude:	9.0	—	6.0	—	6.0	7.0	5.2
Apparent size:	28'	5'	90' by 40'	8'	7'	11'	32'
Distance:	5,200 light-years	5,500 light-years	5,200 light-years	5,800 light-years	7,000 light-years	5,000 light-years	10,400 light-years
Visible:	S. of lat. 65° N.	S. of lat. 62° N.	S. of lat. 65° N.	S. of lat. 65° N.	S. of lat. 76° N.	S. of lat. 73° N.	S. of lat. 66° N.

IF YOU LIKE THIS OBJECT, be sure to observe:
The North America Nebula (NGC 7000) — page 62 • 47 Tucanae (NGC 104) — page 74 • The Orion Nebula (M42) — page 92

Look for these celestial targets nearby:

- ››› **M10,** a magnitude 6.6 globular cluster, lies 22.3° west-northwest of M16.
- ››› **M12,** a magnitude 6.1 globular cluster, lies 25.5° west-northwest of M16.
- ››› **M14,** a magnitude 7.6 globular cluster, lies 14.7° northwest of M16.
- ››› **M18,** a magnitude 6.9 open cluster, lies 0.9° south-southwest of M17.
- ››› **M21,** a magnitude 5.9 open cluster, lies 0.7° northeast of M20.
- ››› **M28,** a magnitude 6.9 globular cluster, lies 2.9° west-southwest of M22.
- ››› **M69,** a magnitude 7.4 globular cluster, lies 7.5° southeast of the Ink Spot.

Nebula (M8). Around 1680, English astronomer John Flamsteed (1646–1719) discovered what became the eighth Messier object.

M8 measures 3 times as wide as the Full Moon, and you'll be able to follow most of the nebulosity through your telescope. A dark lane (the lagoon) cuts the object in half. East of the rift, you'll see three dozen stars of open cluster NGC 6530 embedded in the gas.

The brightest star west of the lane is 8th-magnitude 9 Sagittarii, which is responsible for the nebula's glow. A bit more to the west is M8's core, a region of intense brightness. Look for the Hourglass Nebula, a star-forming region with lots of young stars.

An often overlooked object in Sagittarius is **NGC 6559**. For imagers, few regions of nebulosity show the variety of color and detail that NGC 6559 does. Dark, wispy clouds hang delicately in the foreground of diffuse, glowing hydrogen gas. Follow the clouds toward a bright red arc of gas that shields luminous stars behind it. Even though these stars try to push away the gas and dust near them, thick portions remain and continue to scatter light. This colors the area with hints of blue and purple. Use a nebula filter to see the emission nebulosity, but remove the filter if you're looking for blue reflection nebulosity.

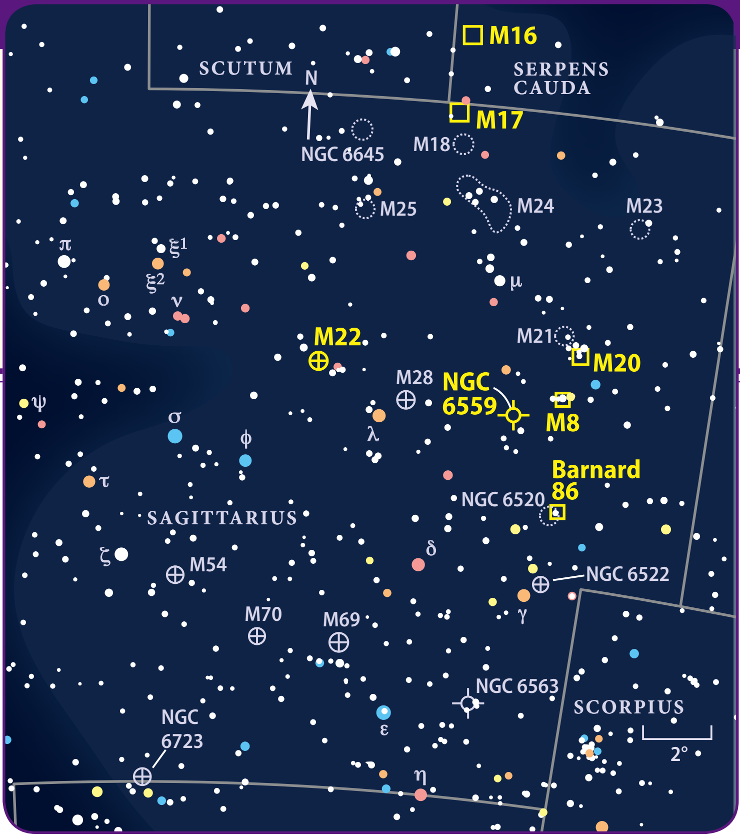
M22 was probably the first globular cluster discovered. German amateur Johann Abraham Ihle found it in 1665. DOUG MATTHEWS/ADAM BLOCK/NOAO/AURA/NSF

Our next target lies in Serpens. The **Eagle Nebula** (M16) combines open cluster NGC 6611 and emission nebula IC 4703.

Through a 6-inch scope, the cluster comprises about a dozen stars brighter than magnitude 10 and several dozen fainter components, which gives it a nice three-dimensional appearance. The dark nebula that helps make up the Eagle's body lies to the southeast.

Back in Sagittarius 2.5° south-southeast of the Eagle Nebula, lies the **Omega Nebula** (M17). Swiss astronomer Phillippe Loys de Chéseaux (1718–1751) discovered M17 (and M16) about 1746.

Through a 6-inch scope, M17 appears as a bright bar 7' long with a short extension from the west end to the south. Increase the magnification past 150x, and the extension reveals itself as a hook-shaped feature with dark material obscuring light from its central region. Through a 12-inch or larger scope, you'll see much more nebulosity — and the brightest regions will show fine striations.



THE AREA NEAR OUR GALAXY'S CENTER abounds with deep-sky objects. Sagittarius contains six of our 100 celestial wonders. Each target contains lots of detail, so move slowly from one object to the next.

The seventh — and easternmost — wonder in this region is globular cluster **M22**. This easy naked-eye object ranks as the sky's third-brightest globular, exceeded only by Omega Centauri (page 36) and 47 Tucanae (page 74).

When you observe M22, altitude — height above the horizon — is everything. Many amateurs in Northern Europe, Canada, and the northern United States are unaware of this cluster's magnificence because, for them, it hugs the southern horizon. See it high in the sky, however, and you'll understand why it made this list.

Through even a 4-inch scope, you'll see several dozen stars. Move up to a 10-inch scope, and you'll be overwhelmed by hundreds of member stars. You can try counting them by dividing M22 into eight wedge-shaped pieces. Count the stars in just one wedge, then multiply by 8. 100

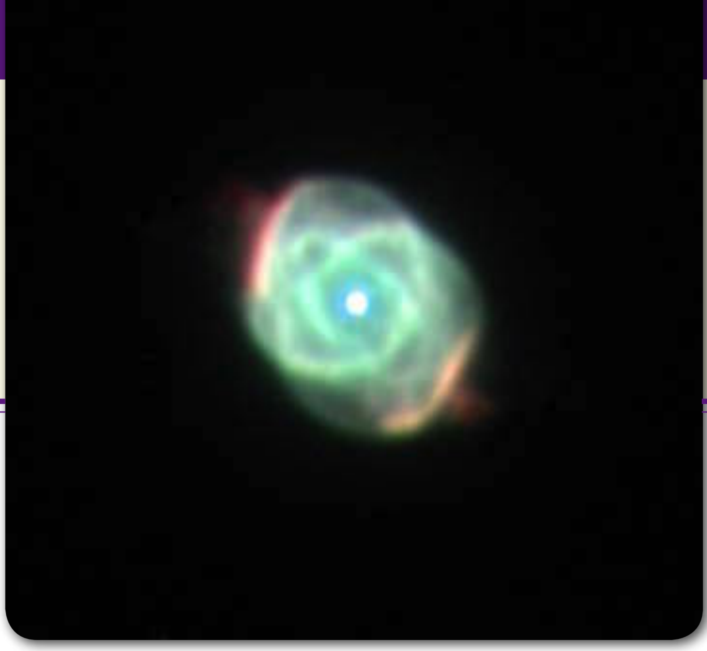
THE EAGLE NEBULA (M16) in Serpens is a star-forming region that combines an open star cluster and an emission nebula. R. JAY GABANY

THE OMEGA NEBULA (M17) hides the stars that formed it. Astronomers sometimes call M17 the Horseshoe Nebula. ADAM BLOCK/NOAO/AURA/NSF

BEST SEEN: **JUNE 21**

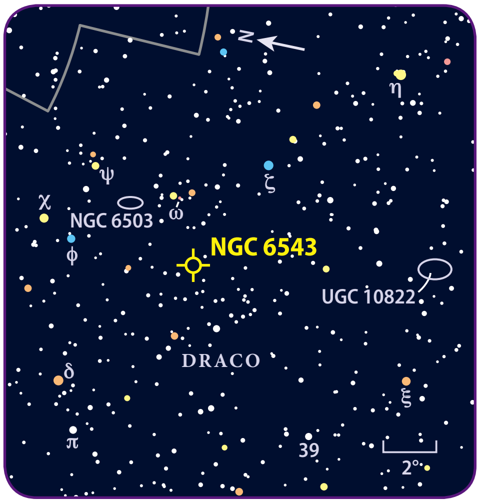
50 The Cat's Eye Nebula

Planetary nebula in Draco



THE CAT'S EYE NEBULA (NGC 6543) lies in Draco. Observe this 8th-magnitude planetary nebula with any size scope. ADAM BLOCK/NOAO/AURA/NSF

FINDING NGC 6543 is an easy star-hop: Drop 3° southeast of magnitude 4.8 Omega (ω) Draconis. NGC 6543 sits an equal distance from Zeta (ζ) and Psi (ψ) Draconis.



Planetary nebulae rank among the sky's best objects for amateur telescopes. Many have high surface brightnesses, most of the bright ones display some color (between green and blue), and all respond well to nebula filters. Near the top of any observer's planetary-nebula list sits the Cat's Eye Nebula.

Sir William Herschel discovered NGC 6543 February 15, 1786. English amateur astronomer William Huggins (1824–1910) examined the Cat's Eye Nebula spectroscopically in 1864, making it the first planetary nebula to be so studied.

Before this date, astronomers thought such objects were unresolvable spheres of stars. Huggins, however, recognized the spectrum to be that of a luminous gas different from those of stars he observed through his spectroscope.

The Cat's Eye Nebula lies almost exactly in the direction of the North Ecliptic Pole. This celestial point lies 90° north of the ecliptic, which is the plane defined by Earth's orbit around the Sun. The corresponding South Ecliptic Pole lies 180° away, in the constellation Dorado.

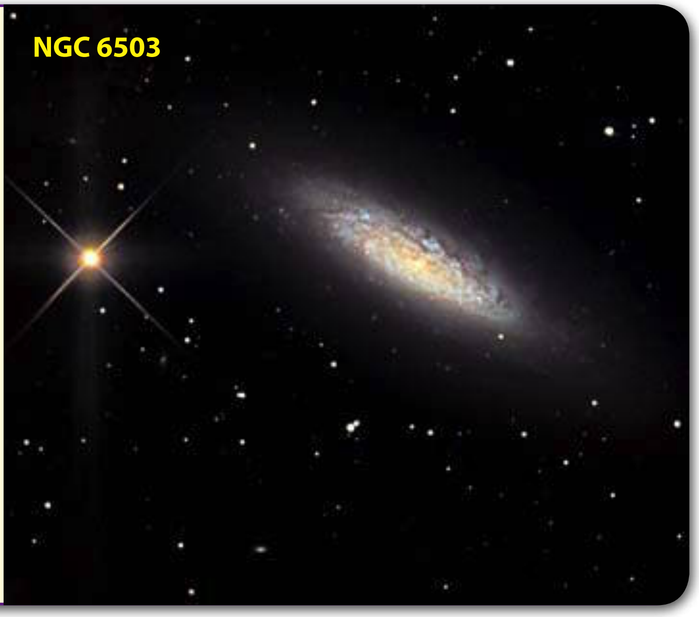
Through an 8-inch or larger telescope, most observers note NGC 6543's blue-green color immediately. Crank the power up to 200x or more, and look for spiral structure around the bright central star.

Although catalogs give the Cat's Eye Nebula's size as 0.3', that's not the end of the story. You'll need a 12-inch or larger scope to spot NGC 6543's outer shell, which measures some 5' across.

Also, with an instrument of this aperture, you'll see what looks like an elliptical galaxy 2' west of the central star. In fact, several astronomical catalogs misidentify this detached region as a galaxy. It even carries its own designation — IC 4677. 100

Look for these celestial targets nearby:

- ››› **NGC 6217,** a magnitude 11.0 spiral galaxy, lies 13.1° north-northwest.
- ››› **NGC 6340,** a magnitude 11.0 spiral galaxy, lies 7° north-northwest.
- ››› **NGC 6503,** a magnitude 10.2 spiral galaxy, lies 3.6° north-northwest.
- ››› **UGC 10822,** a magnitude 12.1 elliptical galaxy, lies 9.8° south-southwest.



RAY J. GaBANY

Cat's Eye Nebula statistics

Also known as: NGC 6543 and Caldwell 6
Right ascension: 17h59m
Declination: 66°38'
Magnitude: 8.1
Apparent size: 0.3'
Distance: 3,600 light-years
Visible: North of latitude 23° S.

IF YOU LIKE THIS OBJECT, be sure to observe:
The Jewel Box (NGC 4755) — page 32 • The Northern Jewel Box (NGC 6231) — page 43 • The Pleiades (M45) — page 87

51 The Wild Duck Cluster

Open cluster in Scutum

Wild Duck Cluster statistics

Also known as: M11 and NGC 6705

Right ascension: 18h51m

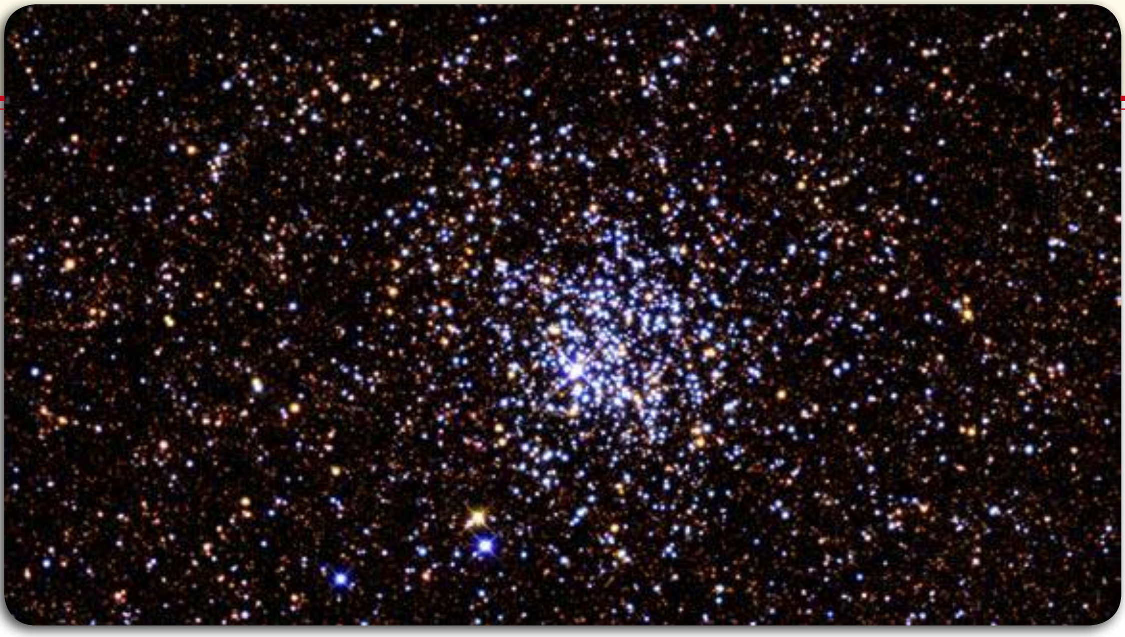
Declination: –6°16'

Magnitude: 5.3

Apparent size: 14'

Distance: 6,000 light-years

Visible: South of latitude 84° N.



THE WILD DUCK CLUSTER (M11) in Scutum swarms with stars, and a rich Milky Way star field surrounds it. Use 75x to 100x through an 8-inch or larger telescope for the best views. R. JAY GABANY

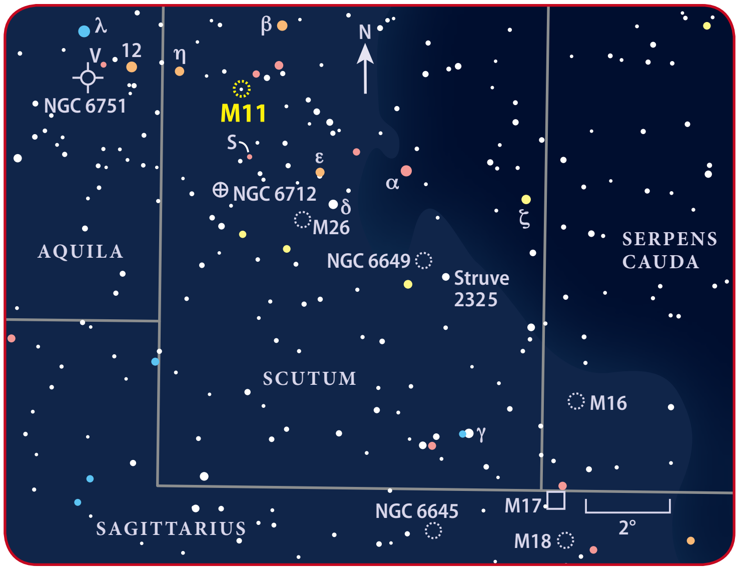
Summer north of the equator is — by far — the best time to view our galaxy's rich star fields. Numerous surprises await the careful deep-sky observer. And it's during summer that the spectacular Wild Duck Cluster flies through the Milky Way.

German astronomer Gottfried Kirch (1639–1710) discovered the Wild Duck Cluster in 1681. Around 1732, English naturalist and astronomer William Derham (1657–1735) first resolved the cluster into stars. Charles Messier made this object the 11th entry in his catalog May 30, 1764.

The common name originated in *A Cycle of Celestial Objects*, written by Admiral William H. Smyth (1788–1865) in 1844. Of M11, Smyth wrote: “A splendid cluster of stars on the dexter chief [upper-right corner] of Sobieski's shield. This object, which somewhat resembles a flight of wild ducks in shape, is a gathering of minute stars with a prominent 8 mag. star in the middle and two following: these are decidedly between us and the cluster.”

From a dark site, sharp-eyed observers will spot M11 with their unaided eyes by following a curved line of stars of decreasing brightness. Start with magnitude 3.4 Lambda (λ) Aquilae; move to 4th-magnitude 12 Aql; finally, proceed to magnitude 4.8 Eta (η) Scuti, which will lead you to M11.

An ideal telescope size and magnification for this object are 8 inches and 75x. More aperture and higher powers will help you resolve additional stars; however, through this combo you'll see more than 100 stars. M11's core, which resembles a poor globular cluster, is tightly packed, and streamers of stars and dark lanes emanate from the central region in all directions.



LOOK FOR M11 4° west-southwest of Lambda (λ) Aquilae, the magnitude 3.4 star that marks the Eagle's “tail.”

Look for these celestial targets nearby:

- ››› **M26,** a magnitude 8.0 open cluster, lies 3.4° south-southwest.
- ››› **NGC 6751,** a magnitude 11.9 planetary nebula, lies 3.7° east.
- ››› **NGC 6772,** a magnitude 12.7 planetary nebula, lies 6.9° east-northeast.
- ››› **NGC 6778,** a magnitude 12.3 planetary nebula, lies 8.3° north-east.

IF YOU LIKE THIS OBJECT, be sure to observe:

M41 — page 6 • The Beehive Cluster (M44) — page 12 • The Pleiades (M45) — page 87

BEST SEEN: **JULY 4**

52 The Ring Nebula

Planetary nebula in Lyra

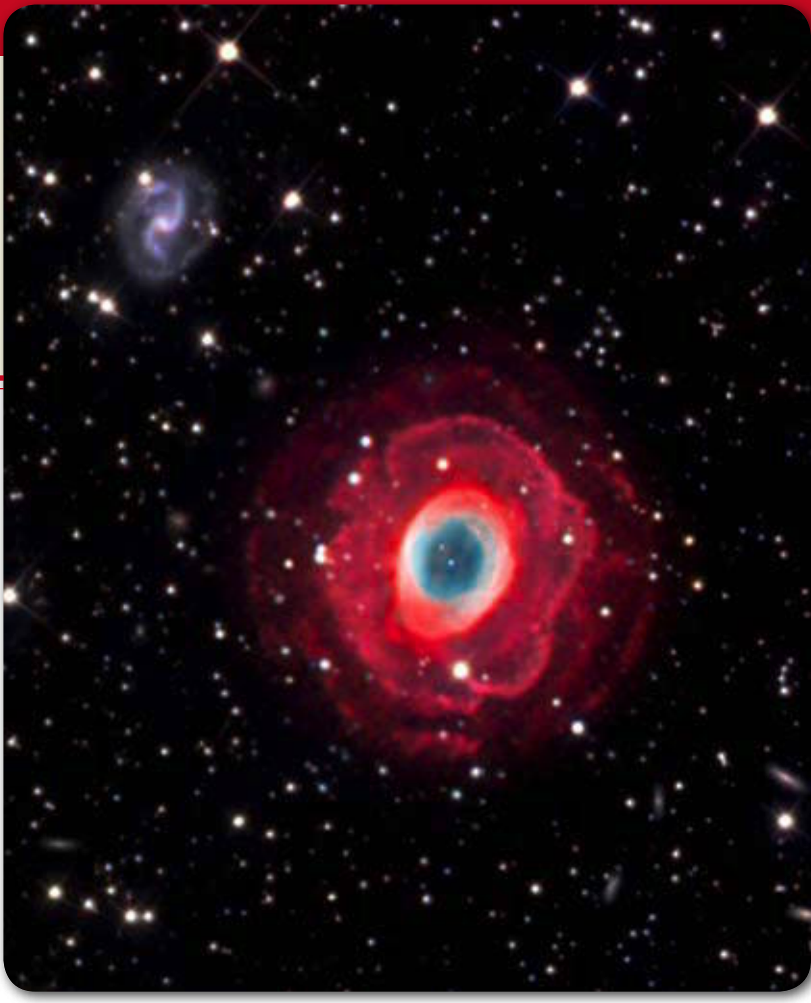
Summer star parties in the Northern Hemisphere just wouldn't be the same without the Ring Nebula. At a glance, this object — a gaseous ring surrounding a faint white-dwarf star — illustrates the fate of Sun-like stars. Also, the Ring is easy to find. It lies midway between two 3rd-magnitude stars: Beta (β) and Gamma (γ) in the bright constellation Lyra.

French astronomer Antoine Darquier de Pellepoix (1718–1802) discovered the Ring Nebula in January 1779. He described it as, "Nebula between Gamma and Beta Lyrae; it is very dull, but perfectly outlined; it is as large as Jupiter & resembles a (fading) planet." Charles Messier added it to his catalog later in 1779. He independently discovered the Ring while observing the comet of 1779, which passed close to M57.

Through a 6-inch telescope from a dark site, the Ring Nebula appears oval and elongated in an east-west direction. Through a 12-inch scope, you'll see the ring's disk appears fainter at the oval's ends.

Spotting M57's central star ranks as a difficult observing challenge that will test you, your telescope, and the quality of the sky above your observing site. Through a 16-inch or larger telescope on a night of excellent seeing, use an eyepiece that yields between 300x and 400x. Keep in mind you're searching for a 15th-magnitude star against a background that's not completely dark.

If the central star doesn't show itself immediately, slightly tap on the telescope's tube. At such high magnification, tapping with one finger should suffice. Because the human eye is sensitive to motion, you may see the white dwarf at this point. German astronomer Friedrich von Hahn (1742–1805) discovered the star in 1800.



THE RING NEBULA (M57) in Lyra probably ranks as the sky's most observed planetary nebula. Medium to high magnifications will reveal the ring best. TONY AND DAPHNE HALLAS

Ring Nebula statistics

Also known as: M57 and NGC 6720

Right ascension: 18h54m

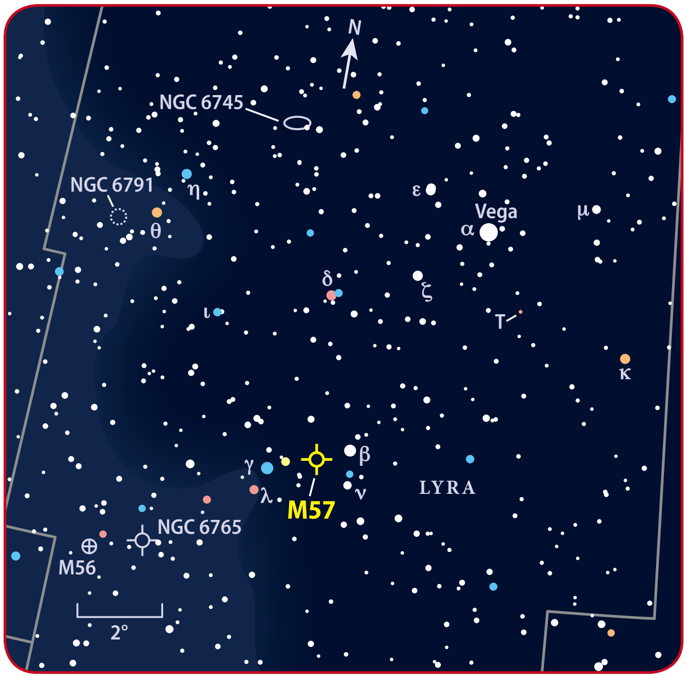
Declination: 33°02'

Magnitude: 8.8

Apparent size: 1.4' by 1'

Distance: 2,300 light-years

Visible: North of latitude 56° S.



M57 lies between two 3rd-magnitude stars in Lyra. You'll locate it 0.8° from Beta (β) and 1.2° from Gamma (γ) Lyrae.

Look for these celestial targets nearby:

››› **M56,** a magnitude 8.4 globular cluster, lies 5.7° east-southeast.

››› **NGC 6745,** a magnitude 13.9 spiral galaxy, lies 7.9° north.

››› **NGC 6765,** a magnitude 12.9 planetary nebula, lies 4.5° east-southeast.

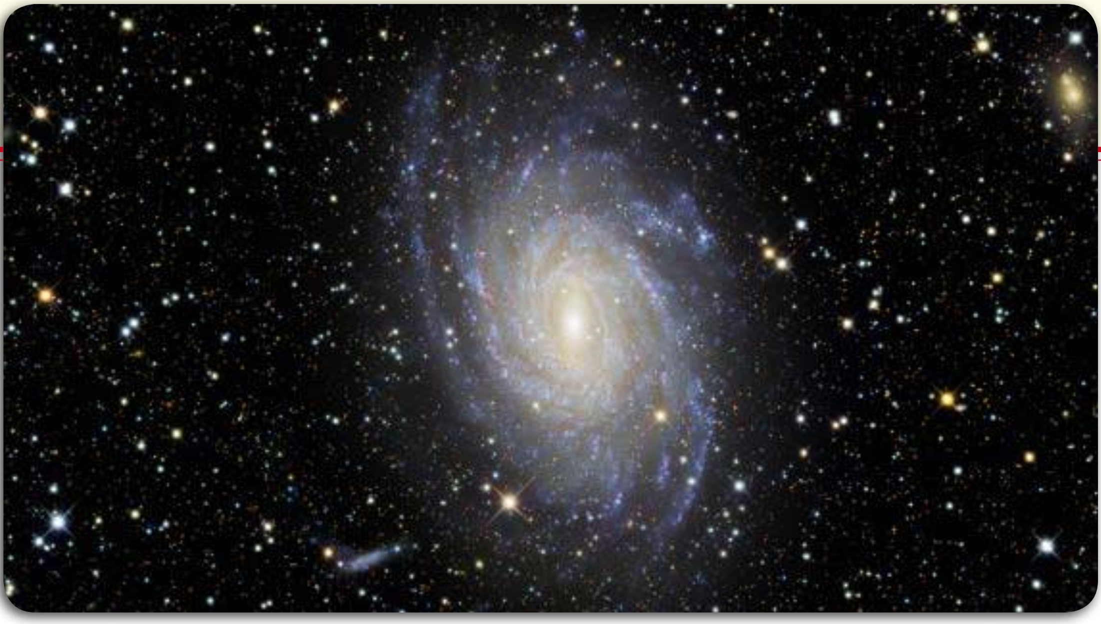
››› **NGC 6791,** a magnitude 9.5 open cluster, lies 7.3° northeast.

IF YOU LIKE THIS OBJECT, be sure to observe:
The Saturn Nebula (NGC 7009) — page 64 • The Helix Nebula (NGC 7293) — page 68 • The Blue Snowball (NGC 7662) — page 72

BEST SEEN: **JULY 8**

53 NGC 6744

Spiral galaxy in Pavo



SPIRAL GALAXY NGC 6744 in Pavo is one of the southern sky's most spectacular galaxies. You'll see NGC 6744's spiral arms even through a small telescope. DANIEL VERSCHATSE

For most *Astronomy* magazine readers, seeing this wonder will require a trip south of the border. The constellation Pavo the Peacock sits so far south it butts up against Octans, the star figure that surrounds the South Celestial Pole. Even from Miami, NGC 6744 climbs less than half a degree above the horizon. It's too bad observers in the continental United States can't observe this wonder.

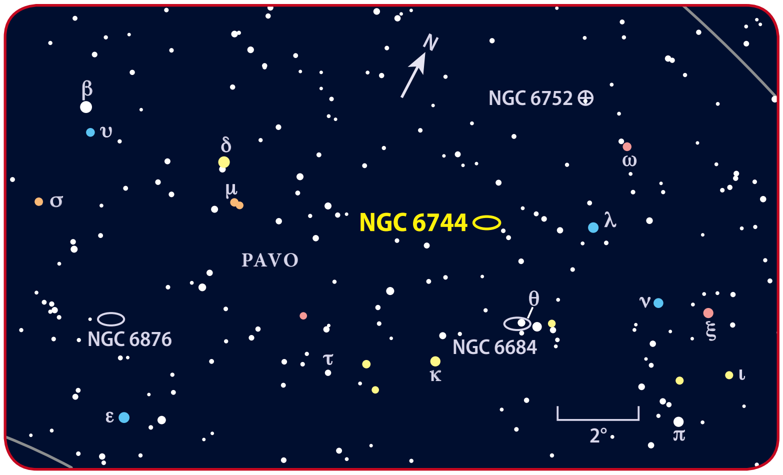
Scottish-born Australian astronomer James Dunlop (1795–1848) discovered NGC 6744 between 1823 and 1827. He made it number 262 in *A Catalogue of Nebulae and Clusters of Stars in the Southern Hemisphere observed in New South Wales* (*Philosophical Transactions of the Royal Society*, volume 118, 1828). Dunlop's catalog contained 629 deep-sky objects visible from southern skies.

Although NGC 6744 shines at 9th magnitude, its surface brightness is low, as in the case of M101 (page 39). In fact, to see NGC 6744's spiral arms, you'll need at least a 10-inch telescope. Through that size instrument, you'll see the galaxy's oval shape; the halo is about 50-percent longer than it is wide.

The outer reaches (the spiral arms) appear clumpy due to large, massive star clusters. Find a 20-inch scope to peer through, perhaps at a star party, and this galaxy's structure will amaze you.

Look for these celestial targets nearby:

- ››› **NGC 6684,** a magnitude 10.3 spiral galaxy, lies 2.6° west-southwest.
- ››› **NGC 6752,** a magnitude 5.3 globular cluster, lies 3.9° north.
- ››› **NGC 6876,** a magnitude 10.7 elliptical galaxy, lies 9.4° southeast.
- ››› **NGC 7020,** a magnitude 11.8 spiral galaxy, lies 13.2° east-southeast.



NGC 6744 lies in the far-southern constellation Pavo. Find magnitude 4.2 Lambda (λ) Pavonis, and move 2.6° southeast.

NGC 6744 statistics

Also known as: Caldwell 101

Right ascension: 19h10m

Declination: –63°51'

Magnitude: 9.1

Apparent size: 20' by 13'

Distance: 25 million light-years

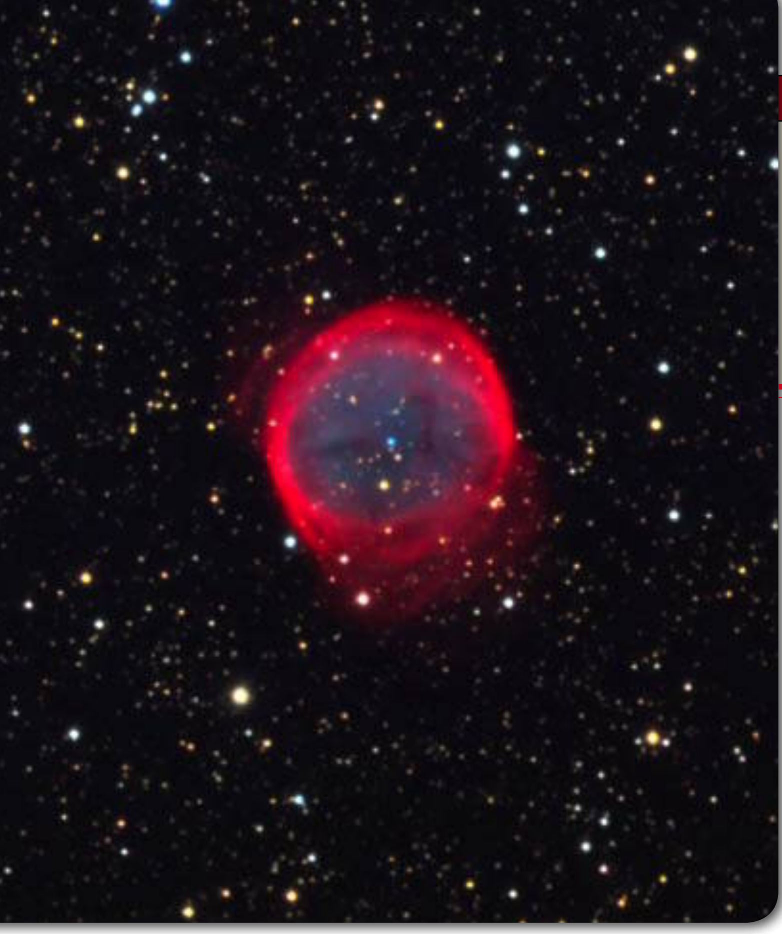
Visible: South of latitude 26° N.

IF YOU LIKE THIS OBJECT, be sure to observe:
M100 — page 23 • M101 — page 39 • The Pinwheel Galaxy (M33) — page 80

BEST SEEN: **JULY 10**

54 NGC 6781

Planetary nebula in Aquila



PLANETARY NEBULA NGC 6781 in Aquila forms a near-perfect bubble of gas ejected by a Sun-like star at the end of its life. ADAM BLOCK/NOAO/AURA/NSF

NGC 6781 statistics

Also known as: PK 41–2.1
Right ascension: 19h18m
Declination: 6°32'
Magnitude: 11.4
Apparent size: 1.8'
Distance: 3,200 light-years
Visible: North of latitude 83° S.

Although Aquila is a prominent star group ranking 22nd in size among the 88 constellations, it contains no Messier objects or emission nebulae and few bright star clusters. Still, you'll want to point your telescope toward this star group to observe planetary nebula NGC 6781.

NGC 6781 is an almost perfectly circular bubble of gas cast off by a single, formerly Sun-like, star that has died. The bubble continues to expand; it measures some 2 light-years across. Energetic photons from nearby bright stars decompose the gas bubble. A similar process occurs within the Eagle Nebula (page 49).

BEST SEEN: **JULY 17**

55 The Blinking Planetary

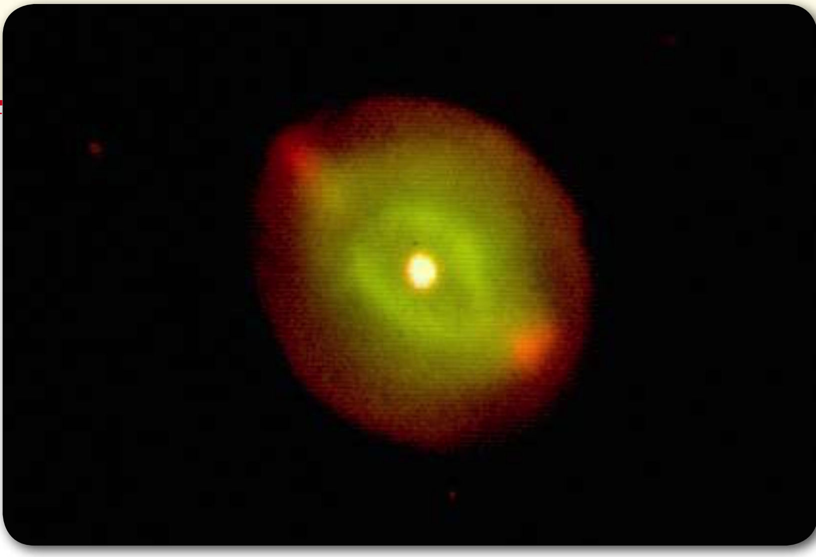
Planetary nebula in Cygnus

The Blinking Planetary statistics

Also known as: NGC 6826 and Caldwell 15
Right ascension: 19h45m
Declination: 50°32'
Magnitude: 8.8
Apparent size: 2.3'
Distance: 3,000 light-years
Visible: North of latitude 39° S.

Cygnus holds many celestial treats because of its position along the northern Milky Way. No less than five objects within that constellation made our top 100. But only one of the celestial wonders within Cygnus blinks ... sort of.

The Blinking Planetary "blinks" because of how the human eye works. When light from any object strikes the eye's center, it falls on the fovea, which contains mainly cone cells. Cone cells account for how well we see, but exciting them takes a lot of light. Surrounding the fovea is the retina, and it's lined with light-sensitive rod cells.



THE BLINKING PLANETARY (NGC 6826) IN CYGNUS looks different when viewed with direct vision (you'll see the star) and averted vision (you'll see the nebula). Don't use too large a scope, or the star's brightness will overwhelm the nebula. BRUCE BALICK/KITT PEAK NATIONAL OBSERVATORY

IF YOU LIKE THIS OBJECT, be sure to observe:
The Eskimo Nebula (NGC 2392) — page 8 • The Cat's Eye Nebula (NGC 6543) — page 48 • The Bow-Tie Nebula (NGC 40) — page 72

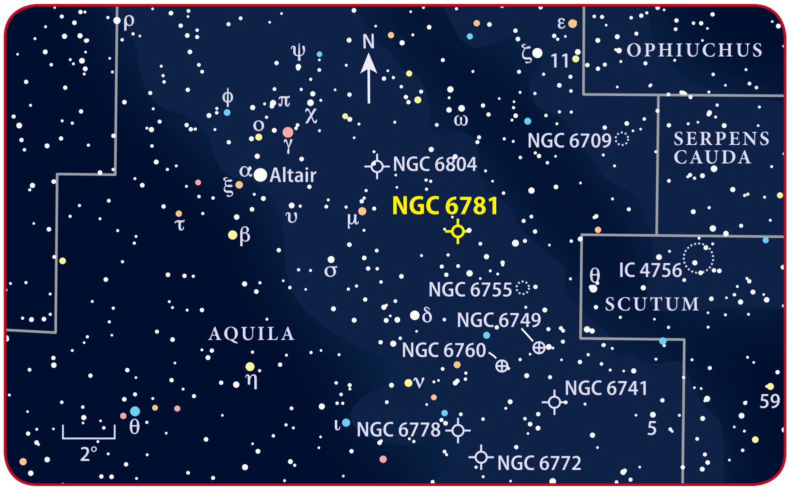
Through a 16-inch or larger telescope, you'll see the central star, a bluish white dwarf, which glows weakly at magnitude 16.2.

Through a 6-inch telescope, NGC 6781 stands out well against a rich, star-filled background. The disk appears soft, irregular, and oval with a slightly darker center. If the seeing at your observing site is good, look for small, dark blotches over NGC 6781's face.

If you're able to observe this planetary through a 16-inch scope, you'll see lots of structure in NGC 6781's thick ring. This feature's southern rim appears brightest. The northern edge is broken and gradually fades into the background. To see the ring best, use a nebula or OIII filter.

Look for these celestial targets nearby:

- ››› **NGC 6749,** a magnitude 12.4 spiral galaxy, lies 5.7° southwest.
- ››› **NGC 6755,** a magnitude 7.5 open cluster, lies 3.5° southwest.
- ››› **NGC 6760,** a magnitude 9.0 globular cluster, lies 5.8° south-southwest.
- ››› **NGC 6804,** a magnitude 12.0 planetary nebula, lies 4.2° northeast.



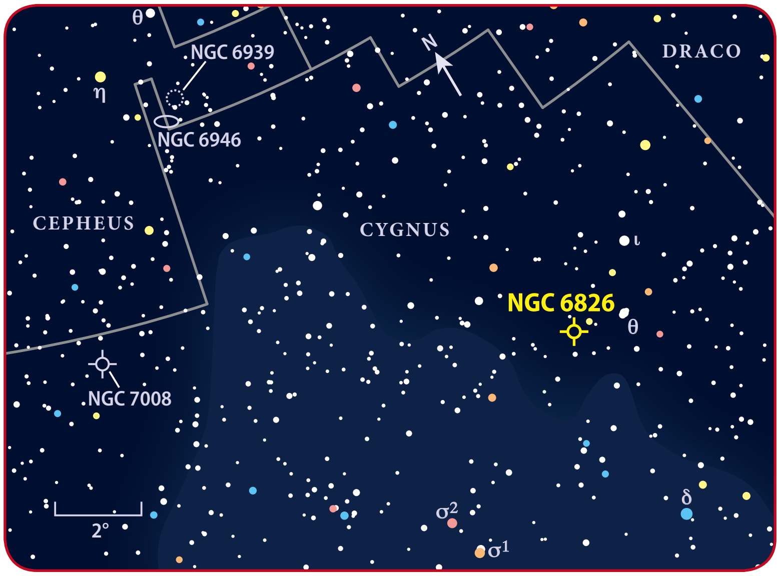
NGC 6781 shines fainter than magnitude 11. Look for it through 6-inch or larger scopes 4.1° north-northwest of magnitude 3.4 Delta (δ) Aquilae.

When you look directly at NGC 6826, its central star is visible. Look off to the side — use averted vision — and the surrounding nebulosity engulfs the star. In essence, the nebula "blinks" on and off.

The Blinking Planetary is a hit at observing sessions, but to see the effect you have to view through the right size scope. Telescopes with apertures of 8 inches or more collect so much light the central star stays visible no matter where you look.

Through 12-inch and larger scopes, look for structure in the planetary's shell, especially the curved, dark area just east of the central star. Use an OIII filter — the best one for planetary nebulae — to reduce the star's brightness.

Sir William Herschel discovered NGC 6826 September 6, 1793. He described it as, "a bright point, a little extended, like two points close to one another; as bright as a star of the 8.9 magnitude; surrounded by a very bright milky nebulosity suddenly terminated, having the appearance of a planetary nebula with a lucid center."



NGC 6826 does, indeed, blink if observed correctly. Prove it to yourself by looking 1.4° east-northeast of magnitude 4.5 Theta (θ) Cygni.

Look for these celestial targets nearby:

- ››› **NGC 6703,** a magnitude 10.7 spiral galaxy, lies 13° west.
- ››› **NGC 6742,** a magnitude 10.5 spiral galaxy, lies 8° west-southwest.
- ››› **NGC 6764,** a magnitude 6.5 open cluster, lies 1.3° to the southwest.
- ››› **NGC 6866,** a magnitude 6.9 open cluster, lies 8.3° southeast.

IF YOU LIKE THIS OBJECT, be sure to observe:
The Ghost of Jupiter (NGC 3242) — page 18 • The Owl Nebula (M97) — page 20 • The Ring Nebula (M57) — page 52

BEST SEEN: **JULY 17**

56 Barnard's Galaxy

Irregular galaxy in Sagittarius

Sagittarius the Archer contains countless nebulae and star clusters, but few galaxies.

American astronomer Edward Emerson Barnard (1857–1923) discovered NGC 6822 in 1884. Apart from the Magellanic Clouds (pages 77 and 90), Barnard's Galaxy is the nearest dwarf irregular galaxy to the Milky Way.

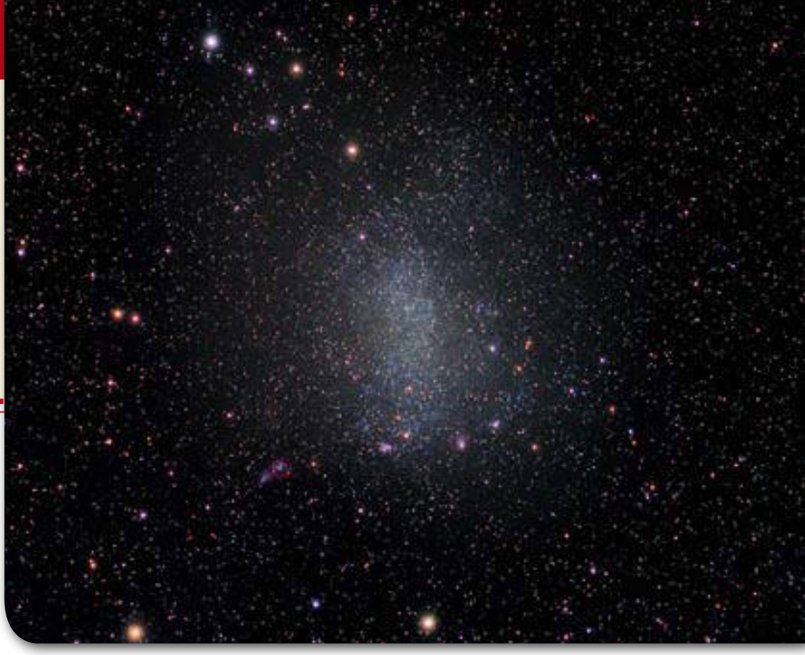
In 1924, American astronomer Edwin Hubble (1889–1953) used several Cepheid variable stars (whose changes in brightness correspond to their luminosities) to measure the distance to Barnard's Nebula, as it was then known. When he calculated their distances, Hubble realized NGC 6822 lies far outside the boundaries of the Milky Way. In a stroke, thousands of "nebulae" — including M31 in Andromeda (page 75) — became galaxies.

Through a 6-inch telescope from a dark site, Barnard's Galaxy proves challenging to observe. Look for a dim haze roughly twice as long as it is wide. Note the slightly brighter streak that spans the long axis.

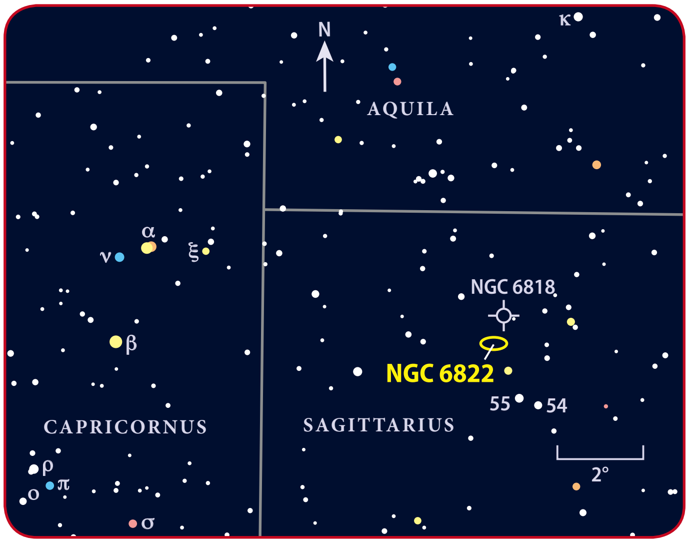
Barnard's Galaxy statistics

Also known as: NGC 6822 and Caldwell 57
Right ascension: 19h45m
Declination: –14°48'
Magnitude: 9.3
Apparent size: 16' by 14'
Distance: 1.6 million light-years
Visible: South of latitude 75° N.

Larger scopes show several star-forming regions along the galaxy's northern end. To see just these regions better, use a nebula filter. Overall, however, such a filter will darken NGC 6822. Without a filter, and through a 12-inch or larger scope, look for individual supergiant stars in Barnard's Galaxy. They're faint — the brightest glow at only 14th magnitude, but they reveal themselves by lending a granular appearance to the galaxy.



BARNARD'S GALAXY (NGC 6822) in Sagittarius provides a challenge to observers because of its low surface brightness. American astronomer Edward Emerson Barnard discovered it in 1884. DANIEL VERSCHATSE



A WIDE FIELD AND LOW POWER make a good combination when you search for NGC 6822. Star-hop north 1.5° from 55 Sagittarii.

Look for these celestial targets nearby:

- ››› **M75,** a magnitude 8.6 globular cluster, lies 8.7° southeast.
- ››› **NGC 6774,** an open cluster, lies 7° west-southwest.
- ››› **NGC 6814,** a magnitude 11.3 spiral galaxy, lies 4.5° north.
- ››› **The Little Gem (NGC 6818),** a magnitude 9.3 planetary nebula, lies 0.7° north-northwest.

JEFF HAPEMAN/ADAM BLOCK/NOAO/AURA/NSF

IF YOU LIKE THIS OBJECT, be sure to observe:
The Whale Galaxy (NGC 4631) — page 29 • Centaurus A (NGC 5128) — page 34 • The Small Magellanic Cloud — page 77

BEST SEEN: **JULY 21**

57 The Dumbbell Nebula

Planetary nebula in Vulpecula

The Dumbbell Nebula statistics

Also known as: M27 and NGC 6853
Right ascension: 20h00m
Declination: 22°43'
Magnitude: 7.4
Apparent size: 8' by 5.7'
Distance: 1,250 light-years
Visible: North of latitude 67° S.

Good luck making the shape of a fox out of the stars of the constellation Vulpecula. This faint star pattern's brightest star is magnitude 4.4 Alpha (α) Vul. But observers don't point their scopes toward Vulpecula for stars. They're looking for the Dumbbell Nebula.

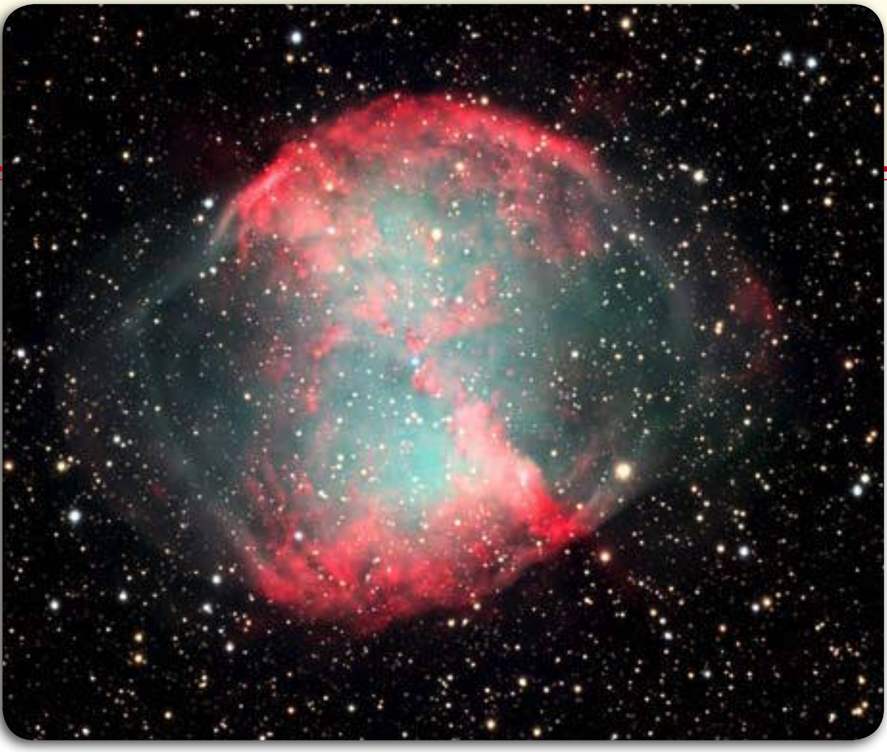
Charles Messier discovered M27 July 12, 1764. It was the first planetary nebula discovered. Of it, he said: "Nebula without star; one can see it well with an ordinary telescope of 3.5-foot [focal length]. It appears of oval shape & it contains no star."

The Dumbbell Nebula owes its common name to a double-lobe symmetry common among planetary nebulae. Astronomers think double stars may explain the most extreme bipolar structures. Strong magnetic fields also could have shaped M27.

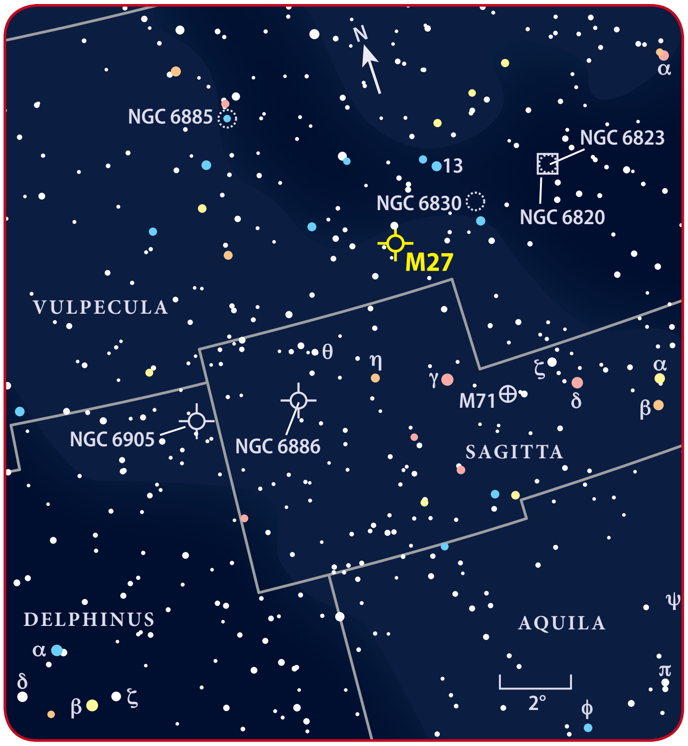
Even through binoculars, this object is easy to spot. To see any of its details, however, you'll need a telescope.

Small telescopes show the two bright lobes and several stars scattered across M27's face. This object responds well to high magnifications because of its high surface brightness. Through a 10-inch scope, crank the power past 300x, and look for striations that cross the inner regions.

Through 14-inch and larger instruments, you'll see thin, faint arcs at both ends of the Dumbbell's lobes. Use a nebula or OIII filter, and you may see the arcs extend until they form an envelope around the inner nebula.



THE DUMBBELL NEBULA in Vulpecula the Fox is one of the largest and closest planetary nebulae. At magnitude 7.4, it's easy to see through small telescopes and spectacular in large ones. JOE AND GAIL METCALF/ADAM BLOCK/NOAO/AURA/NSF



BINOCULARS will reveal M27. It lies north of the star marking the tip of Sagitta's "arrow," magnitude 3.5 Gamma (γ) Sagittae.

Look for these celestial targets nearby:

››› **M71,** a magnitude 8.4 globular cluster, lies 4.2° south-southwest.

››› **NGC 6820,** an emission nebula, lies 4° west.

››› **NGC 6823,** a magnitude 7.1 open cluster, lies 3.8° west.

››› **NGC 6830,** a magnitude 7.9 open cluster, lies 2° west.

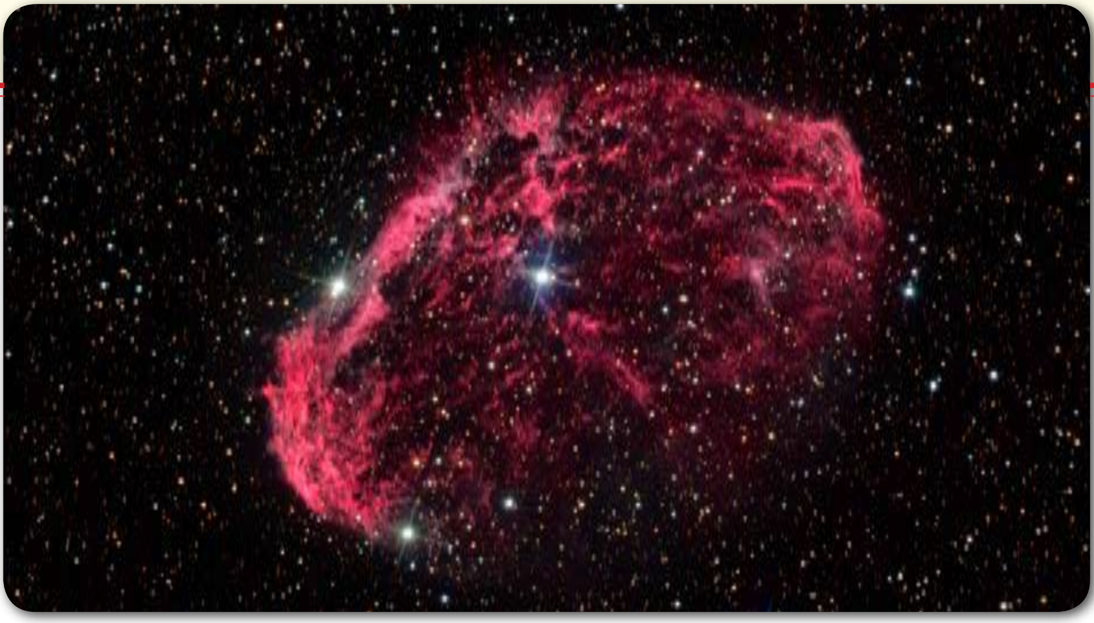
IF YOU LIKE THIS OBJECT, be sure to observe:
The Eskimo Nebula (NGC 2392) — page 8 • The Cat's Eye Nebula (NGC 6543) — page 48 • The Helix Nebula (NGC 7293) — page 68

BEST SEEN: **JULY 24**

58

The Crescent Nebula

Emission nebula in Cygnus



THE CRESCENT NEBULA (NGC 6888) in Cygnus is a cosmic bubble of interstellar gas sculpted by high-energy radiation from a nearby star. BOB AND JANICE FERA

Crescent Nebula statistics

Also known as: NGC 6888 and Caldwell 27

Right ascension: 20h12m

Declination: 38°21'

Magnitude: —

Apparent size: 20'

Distance: 5,000 light-years

Visible: North of latitude 51° S.

Shocking may be astronomers' best way to describe the Crescent Nebula. A fast stellar wind from the Wolf-Rayet star WR 136 formed the Crescent Nebula's shape. This wind collides with a slower stellar wind ejected by the star during its red-giant stage roughly half a million years ago.

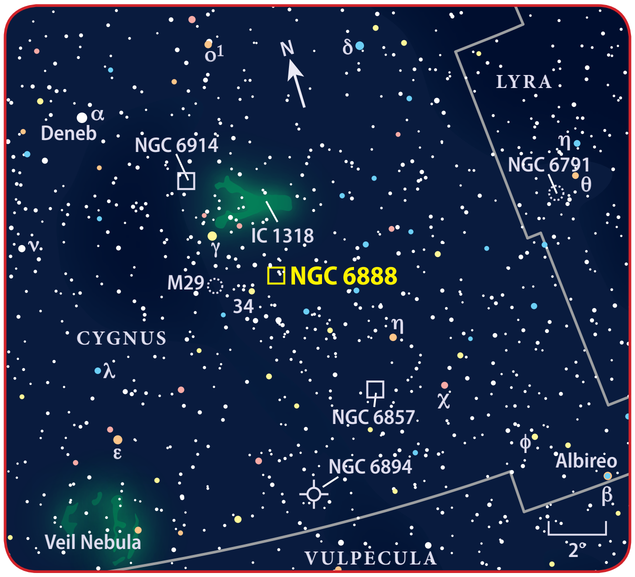
The collision creates two shock waves moving in opposite directions. The inward moving shock wave heats the high-speed stellar wind and causes it to emit X rays. The outward moving shock wave sculpts the surrounding interstellar gas.

French astronomers Charles Wolf and Georges Rayet discovered Wolf-Rayet stars spectroscopically in 1867. Astronomers have since identified about 200 in the Milky Way.

Sir William Herschel discovered the Crescent Nebula September 15, 1792. He described the observation as, "A double star of the 8th magnitude with a faint south preceding milky ray joining to it."

You'll easily spot the magnitude 7 luminary at NGC 6888's center — that's the Wolf-Rayet star powering the nebula. Use a magnification under 100x to see the whole object. The Crescent Nebula's western edge appears as a bright arc; a bar joins the arc's center and WR 136.

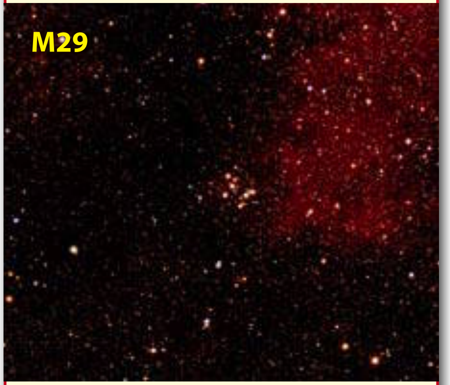
An OIII filter gives the best view of NGC 6888. It reveals the entire nebula and dims, but doesn't block, the rich Milky Way star field that lies beyond. 100



DANIEL VERSCHATSE

TO FIND NGC 6888, start at Gamma (γ) Cygni, drop down 2.4° to 34 Cygni, then move half the distance between those two stars (1.2°) west-northwest.

Look for these celestial targets nearby:



- ››› **M29,** a magnitude 6.6 open cluster, lies 2.3° east.
- ››› **NGC 6819,** a magnitude 7.3 open cluster, lies 6.2° west-northwest.
- ››› **Basel 6,** a magnitude 7.7 open cluster, lies 1° west.
- ››› **Biur 2,** a magnitude 6.3 open cluster, lies 2.9° south.

IF YOU LIKE THIS OBJECT, be sure to observe:

Thor's Helmet (NGC 2359) — page 7 • The Eta Carinae Nebula (NGC 3372) — page 19 • The Bubble Nebula (NGC 7635) — page 71

59 Nebulosity around Gamma Cygni

Emission and reflection nebula in Cygnus

Gamma Cygni Nebula statistics

Also known as: the Butterfly Nebula and IC 1318

Right ascension: 20h17m

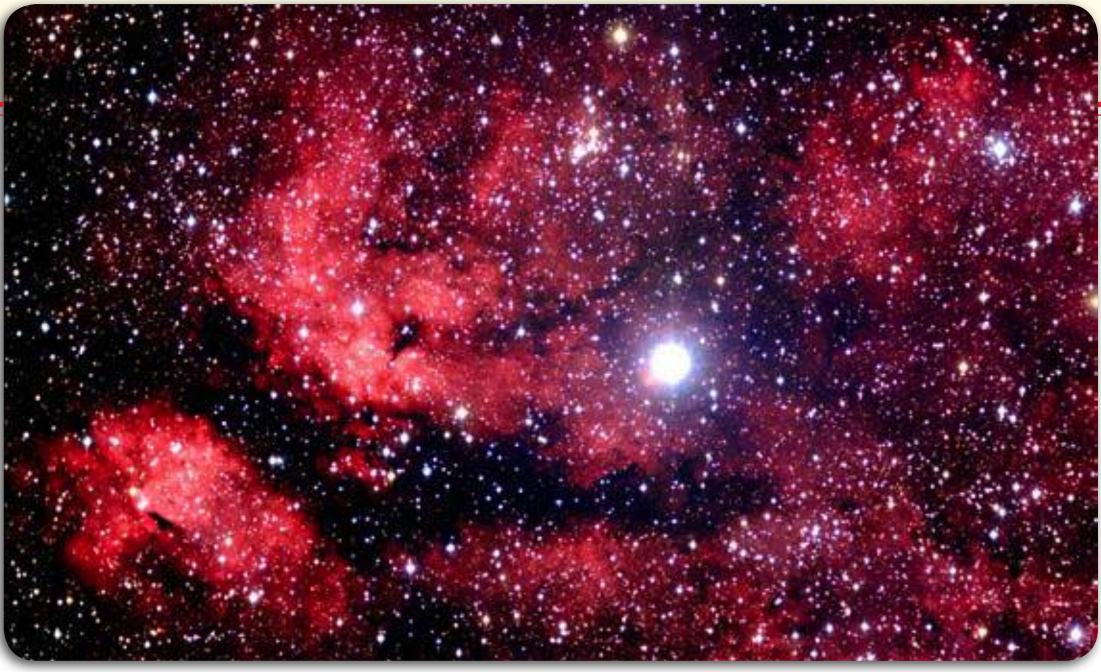
Declination: 41°57'

Magnitude: —

Apparent size: 50'

Distance: 3,700 light-years

Visible: North of latitude 49° S.



NEBULOSITY AROUND GAMMA CYGNI makes the 2nd-magnitude star the least interesting object in this image. TERESA HAWES/PHILIP DARLING/ADAM BLOCK/NOAO/AURA/NSF

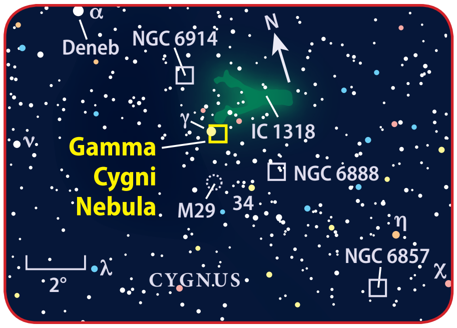
Scanning the northern Milky Way often leads to unexpected discoveries. One region unfamiliar to many amateur astronomers surrounds Cygnus' second-brightest (even though it's labeled with the third Greek letter) star.

Although observers refer to this area as the Gamma Cygni region, astronomers point out that name refers to the position of the nebulosity. It does not imply that the star Gamma (γ) Cygni has anything to do with the nebula. In fact, the clouds of hydrogen in this region lie 5 times as far from us as the star Gamma Cygni.

Ultraviolet radiation from hot blue-white stars ionizes the hydrogen gas, causing it to glow red. Dark nebulae — clouds of dust and cold gas — divide this region into at least five major parts. The brightest cloud, IC 1318, is the large area west (right) of Gamma Cygni and often lends the entire region its name. IC 1318 appears divided by a dark lane. The lane and the corresponding bright areas on either side of it form the Butterfly Nebula.

Also west of Gamma Cygni, but closer to it, lies the combination object (emission nebula plus open cluster) IC 1311. This cloud is larger and fainter than IC 1318.

You can approach observing this region in two general ways. You can choose a magnification of roughly 50x and observe the area as a whole. Alternately, crank up the power, and observe each of the sections individually. In both cases, a nebula filter will help a lot, as will placing magnitude 2.2 Gamma Cygni outside the field of view.



THE GAMMA CYGNI NEBULA reveals itself best to observers with 10-inch or larger telescopes and eyepieces equipped with nebula filters.

ANTHONY AYIOMAMITIS

Look for these celestial targets nearby:

››› **NGC 6910,** a magnitude 7.4 open cluster, lies 0.6° north-northeast.

››› **NGC 6914,** an emission nebula, lies 2.3° north.

››› **Collinder 419,** a magnitude 5.4 open cluster, lies 0.9° west-northwest.

››› **Van den Bergh 130,** a magnitude 9.3 open cluster, lies 1.3° south.

IF YOU LIKE THIS OBJECT, be sure to observe:

The Rho Ophiuchi region — page 40 • The Lagoon Nebula (M8) — page 49 • The Orion Nebula (M42) — page 92

60 The Fireworks Galaxy

Spiral galaxy in Cepheus

Fireworks Galaxy statistics

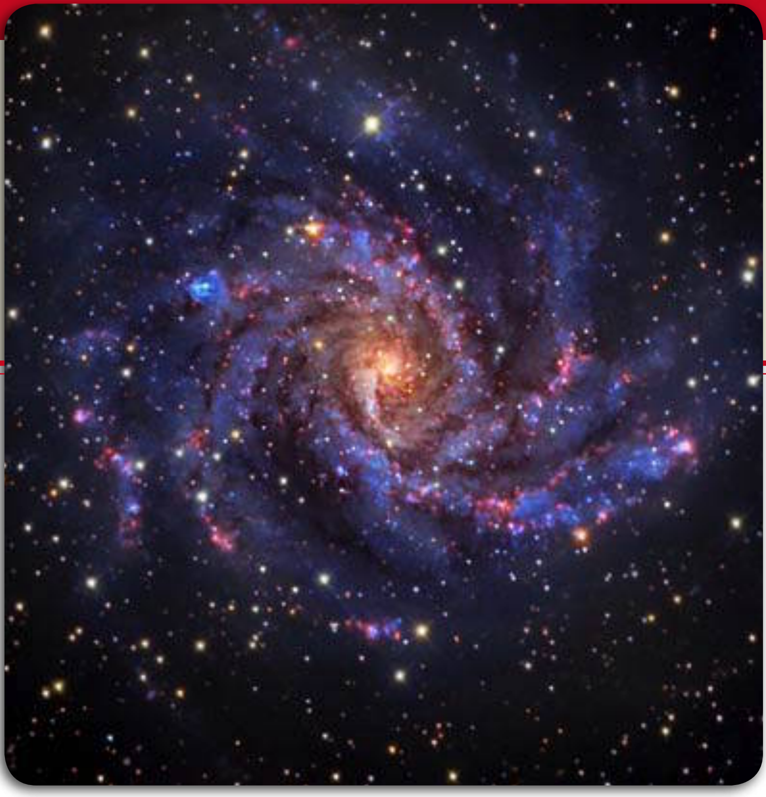
Also known as: NGC 6946 and Caldwell 12
Right ascension: 20h35m
Declination: 60°09'
Magnitude: 8.9
Apparent size: 11'
Distance: 10 million light-years
Visible: North of latitude 29° S.

How can a galaxy be bright and faint simultaneously? The answer hinges on the object's surface brightness. In the case of NGC 6946, its overall brightness may be high, leading to a showy magnitude of 8.9. Unfortunately, however, that light spreads over an area 11' across.

Another hindrance to the Fireworks Galaxy's brightness is its location near the Milky Way's plane in Cepheus. So, the overall impression of NGC 6946, unless you're using a large telescope, is of a faint object.

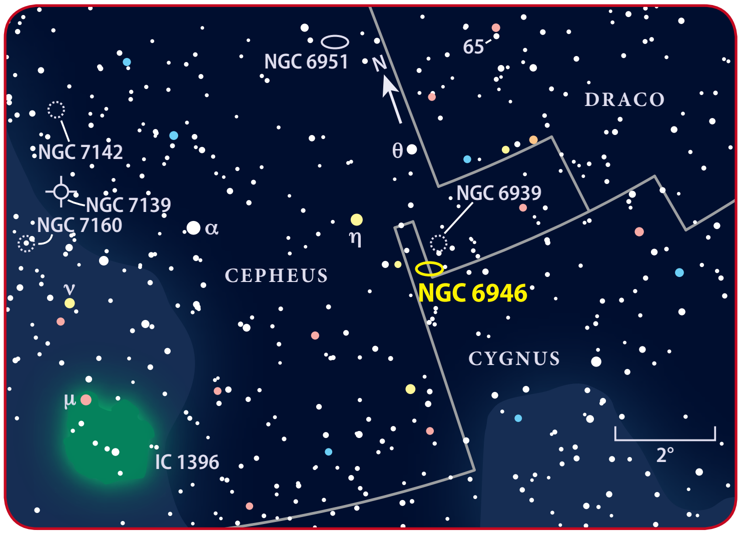
Sir William Herschel discovered NGC 6946 September 9, 1798. For some unknown reason, this galaxy is a hotbed of supernova activity. That's the reason astronomers have dubbed it the Fireworks Galaxy.

In the last century, eight supernovae have appeared in NGC 6946: in 1917, 1939, 1948, 1968, 1969, 1980, 2002, and 2004. The most recent supernova was the brightest, reaching magnitude 12.3 September 30.



SPIRAL GALAXY NGC 6946 in Cepheus shines at 9th magnitude. Its low surface brightness, however, tends to frustrate observers. TONY AND DAPHNE HALLAS

Although small telescopes will allow you to spot NGC 6946, you won't see much detail with apertures less than 12 inches. The galaxy's core appears bright and spans roughly 10 percent of its diameter. Two spiral arms are visible through a 12-inch scope, and you'll see four through a 16-inch or larger instrument. 100



NGC 6946 lies right on the Cepheus-Cygnus border. Look 2.1° southwest of magnitude 3.4 Eta (η) Cephei.

Look for these celestial targets nearby:

BILL MARSH

- ››› **NGC 6811,** a magnitude 6.8 open cluster, lies 16.2° southwest.
- ››› **NGC 6939,** a magnitude 7.8 open cluster, lies 0.7° northwest.
- ››› **NGC 6951,** a magnitude 11.0 spiral galaxy, lies 6° north.
- ››› **NGC 7139,** a magnitude 13.3 planetary nebula, lies 9.1° east-northeast.

IF YOU LIKE THIS OBJECT, be sure to observe:
Bode's Galaxy (M81) — page 15 • **M106** — page 22 • **The Pinwheel Galaxy (M33)** — page 80

BEST SEEN: **AUGUST 4**

61 The Veil Nebula

Supernova remnant in Cygnus

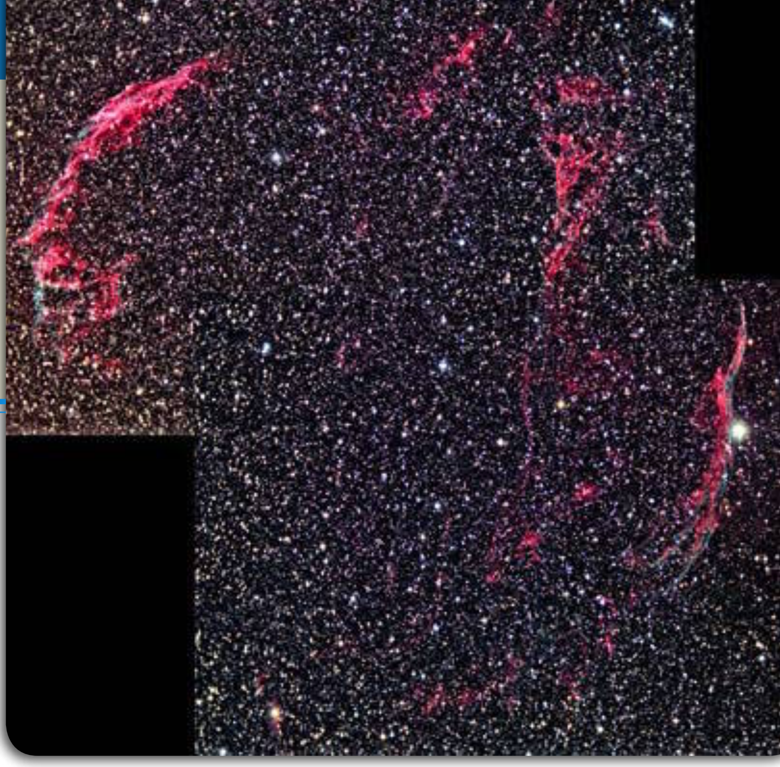
The Veil Nebula tops our list of 100 wonders in two ways. It ranks number one in size. At 3.5°, it measures more than 6 times wider than the Full Moon. It also exceeds all other entries with the most alternative names.

More than 15,000 years ago, the gaseous filaments we now marvel at in the Veil belonged to a massive star on the brink of blowing itself to bits. When it exploded as a supernova, the star would have shone brighter than the crescent Moon. Unfortunately, no record of this event exists.

The Veil Nebula contains two main segments. NGC 6960 wends its way past the star 52 Cygni, which shines at magnitude 4.2. The star is a foreground object unconnected to the supernova remnant. NGC 6960 tapers to a sharp point at the north end of a degree-long glowing strip. As it broadens to the south and passes 52 Cyg, a dark lane splits the nebulosity into two sections.

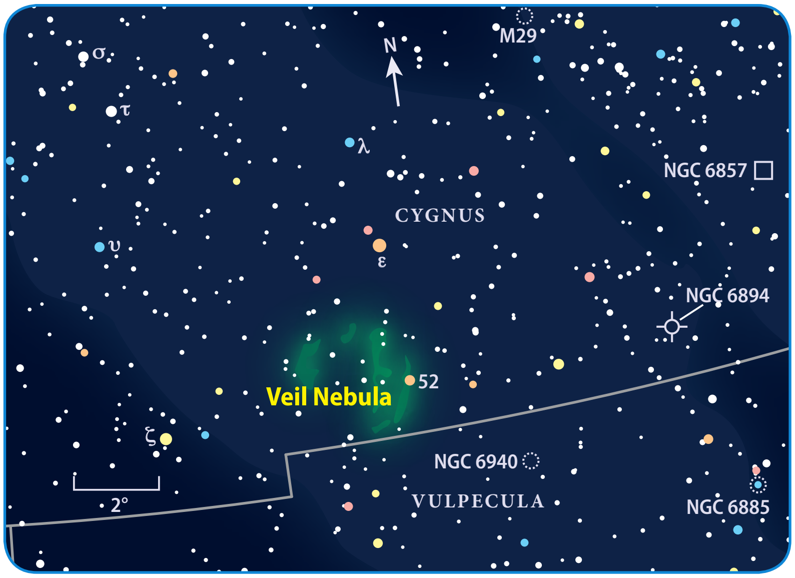
The Veil Nebula's brightest segment, NGC 6992/5, lies 2.7° northeast of 52 Cyg. Through an 8-inch scope at medium magnification (around 100x), the nebula breaks into numerous strands.

More nebulosity lies between the northern ends of the Veil's two main sections. Look for NGC 6979, the northernmost triangular bright patch. American astronomer Williamina Fleming (1857–1911) discovered this nebulous region in 1904 while working at Harvard Observatory. She named it Pickering's Triangle in honor of the observatory's director, American astronomer Edward Charles Pickering (1846–1919). The nebula also goes by Pickering's Wedge and Fleming's Wisp.



THE VEIL NEBULA (NGC 6960 and NGC 6992/5) **represents a magnificent supernova remnant complex in Cygnus. This object stretches across more than 3° of sky, so use low power and a nebula filter, and manually scan all around.** ADAM BLOCK/NOAO/AURA/NSF

For best results when observing the Veil Nebula, use a 10-inch or larger telescope and the eyepiece that gives the lowest magnification. Insert a nebula filter, disconnect the scope's drive (so you can move it freely), and pan this area. Take your time. There's a lot to see.



ALONG THE NORTHERN MILKY WAY, the Veil Nebula sits within a right triangle formed by the stars Epsilon (ε), Zeta (ζ), and 52 Cygni.

Veil Nebula statistics

Also known as: the Bridal Veil Nebula, the Cygnus Loop, the Filamentary Nebula, the Network Nebula, the Witch's Broom, NGC 6960/74/79/92/95, Caldwell 33 (NGC 6992/5), and Caldwell 34 (NGC 6990)

Right ascension: 20h56m

Declination: 31°43'

Magnitude: —

Apparent size: 210' by 160'

Distance: 1,400 light-years

Visible: North of latitude 58° S.

Look for these celestial targets nearby:

- ››› **NGC 6885,** a magnitude 8.1 open cluster, lies 8.5° west-southwest.
- ››› **NGC 6940,** a magnitude 6.3 open cluster, lies 3.5° southwest.
- ››› **NGC 7013,** a magnitude 11.5 spiral galaxy, lies 4° east.
- ››› **NGC 7063,** a magnitude 7.0 open cluster, lies 9.9° northeast.

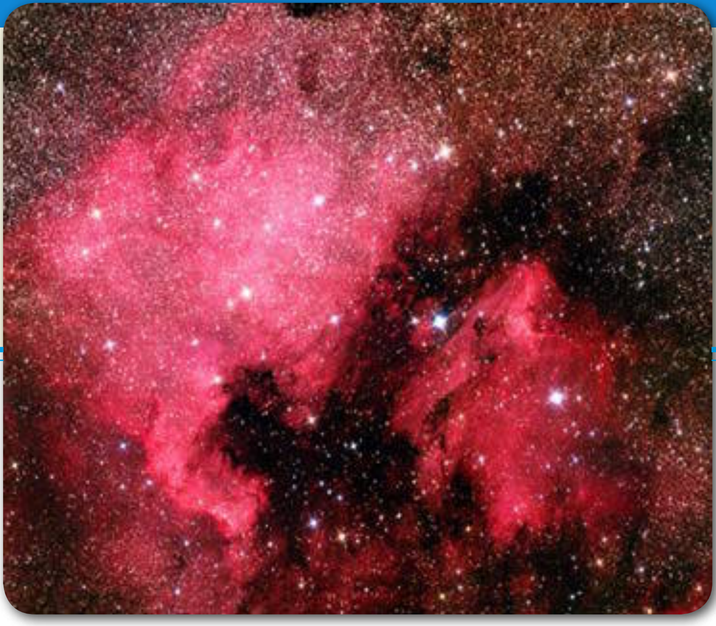
IF YOU LIKE THIS OBJECT, be sure to observe:

The Pencil Nebula (NGC 2739) — page 13 • The Heart Nebula (IC 1848) — page 83 • The Tarantula Nebula (NGC 2070) — page 94

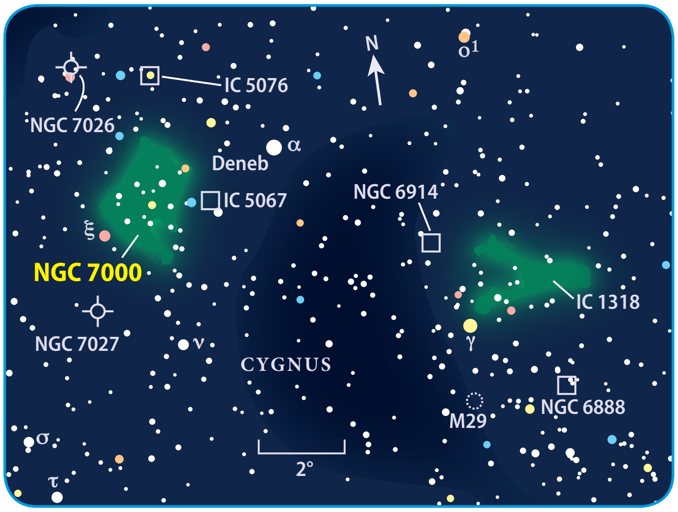
BEST SEEN: **AUGUST 4**

62 The North America Nebula

Emission nebula in Cygnus



THE NORTH AMERICA NEBULA in Cygnus measures 2° across. Can you see this object, which lies near Deneb (Alpha [α] Cygni), with your naked eyes? If not, use a nebula filter. ADAM BLOCK/NOAO/AURA/NSF



THE DIFFUSE GLOW of the North America Nebula, visible to the naked eye on dark nights, lies southeast of the bright star Deneb in Cygnus, just west of the star Xi (ξ) Cygni.

Few deep-sky objects with "common" names truly look like their namesakes. Not so with the North America Nebula. A glance at this object reveals the California coast, Mexico, the Gulf of Mexico, and even a faint Florida. It took more than 100 years, however, for people to see the similarity.

Sir William Herschel discovered the North America Nebula October 24, 1786. He described it as "Very large diffused nebulosity, brighter in the middle, 7' or 8' long. 6' broad and losing itself very gradually and imperceptibly."

German astronomer Max Wolf (1863–1932) was the first to photograph this object, on December 12, 1890. He dubbed it the America Nebula, from which its current moniker derives.

From a dark site, sharp-eyed observers can see NGC 7000 with their naked eyes. Look roughly 3° east of Deneb (Alpha [α] Cygni). Averted vision — looking slightly away from a faint celestial object — will help you locate the nebula's densest regions.

North America Nebula statistics

Also known as: NGC 7000 and Caldwell 20
Right ascension: 20h59m
Declination: 44°20'
Magnitude: —
Apparent size: 120' by 100'
Distance: 1,600 light-years
Visible: North of latitude 45° S.

The whole continent will not be apparent at first glance. Start by finding the brightest part — Mexico — then patiently, and with averted vision (looking slightly away from the target), try to see the rest. Don't give up on trying to find it with just your eyes until you've searched through a nebula filter.

Low-power telescope views that provide at least a 2° field of view are best. And don't forget the nebula filter. Some observers have had good luck attaching two similar nebula filters to the eyepieces of binoculars.

While you're out observing the North America Nebula, hop a short 1° west to locate the Pelican Nebula (IC 5067). While unfiltered telescopic views of NGC 7000 may show detail, the same cannot be said about the Pelican Nebula.

You also won't see the Pelican with your unaided eyes. Use an 8-inch or larger telescope, and look for a dark break in the overall nebulous glow that signals the pelican's bill. Again, start with low magnification, and work your way up.

Look for these celestial targets nearby:

››› **M39,** a magnitude 4.6 open cluster, lies 6.9° northeast.

››› **NGC 7026,** a magnitude 10.9 planetary nebula, lies 3.6° north-northeast.

››› **IC 5067,** a magnitude 8.0 emission nebula, lies 1.4° west.

››› **IC 5076,** an emission nebula, lies 2.9° north.

R. JAY GaBANY

IF YOU LIKE THIS OBJECT, be sure to observe:
The Eta Carinae Nebula (NGC 3372) — page 19 • The Omega Nebula (M17) — page 49 • The Orion Nebula (M42) — page 92

BEST SEEN: **AUGUST 5**

63 The Iris Nebula

Reflection nebula in Cepheus

Iris Nebula statistics

Also known as: NGC 7023 and Caldwell 4

Right ascension: 21h01m

Declination: 68°10'

Magnitude: 7

Apparent size: 18'

Distance: 1,400 light-years

Visible: North of latitude 21° S.

Imagine a cloud of countless particles, each measuring less than a millionth of a millimeter wide. Together, however, these particles function as a special type of cosmic mirror we know as the Iris Nebula.

Sir William Herschel discovered the Iris Nebula October 18, 1794. He wrote in his journal it appeared as, “A star of 7th magnitude. Very much affected with nebulosity, which more than fills the field. It seems to extend to at least a degree all around; stars, such as 9th or 10th magnitude, of which there are many, are perfectly free from this appearance.”

The Iris Nebula is the first of our 100 wonders classified as a reflection nebula, which is a cloud of dust and gas that reflects and scatters the light from nearby stars. Scattering gives these nebulae their characteristic blue color. This phenomenon also occurs a lot closer to home: It’s the reason our daytime sky appears blue. Blue light, because of its shorter wavelength, scatters more than red light as it encounters minute dust and water-vapor particles and density variations in the air.

In reflection nebulae, the stars producing the light are either not hot enough or not close enough to ionize the gas. If ionization occurred, the cloud would take on the red color of emission nebulae. Reflection and emission nebulosities often appear together, as in the case of the Trifid Nebula (page 48).

Through a 10-inch telescope, NGC 7023 appears as a uniformly bright, circular haze about 1' across surrounding the 7th-magnitude star HD 200775. Look closely to see a small, detached portion of the nebula just to the south.

Through 16-inch and larger scopes, the nebula’s faint outer halo appears. Use averted vision and you should see about half of the 18' diameter astroimagers capture. 100

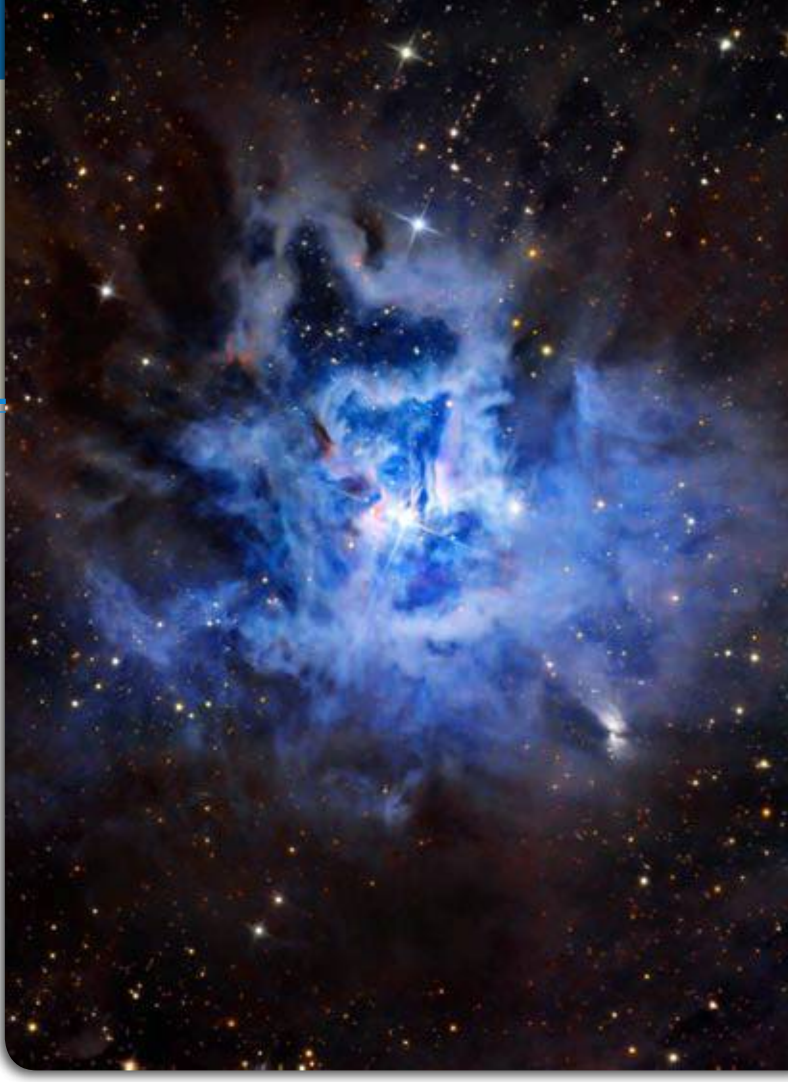
Look for these celestial targets nearby:

››› **NGC 6951,** a magnitude 11.0 spiral galaxy, lies 3.1° southwest.

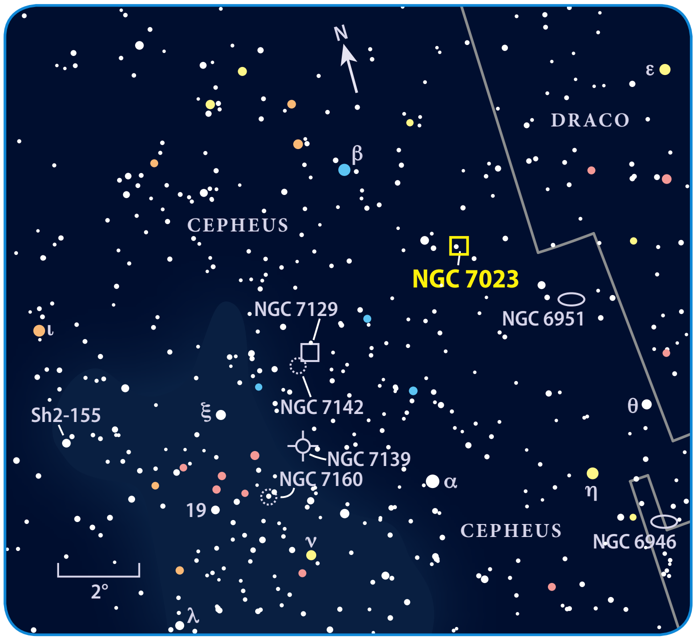
››› **NGC 7129,** a magnitude 10.8 open cluster, lies 4.5° east-southeast.

››› **NGC 7142,** a magnitude 9.3 open cluster, lies 4.9° east-southeast.

››› **Gyulbudaghian’s Nebula,** a magnitude 10.5 reflection nebula, lies 1.8° west-southwest.



THE IRIS NEBULA (NGC 7023) in Cepheus is a reflection nebula. Its blue color comes from the star SAO 19158, which lies near the nebula’s center. Don’t use a filter when observing it. TONY AND DAPHNE HALLAS



YOU’LL FIND NGC 7023 sitting 3.4° southwest of magnitude 3.2 Beta (β) Cephei. The nebula sits in a colorful star field.

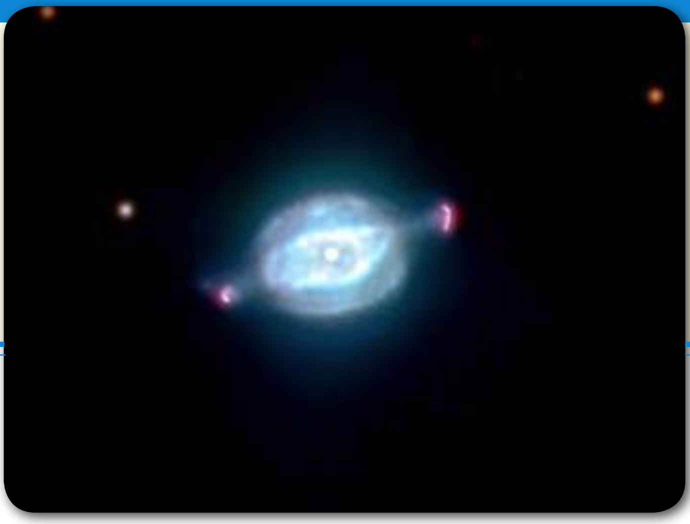
IF YOU LIKE THIS OBJECT, be sure to observe:

The Lagoon Nebula (M20) — page 49 • The Cocoon Nebula (IC 5146) — page 67 • The Cone Nebula (NGC 2264) — page 98

BEST SEEN: **AUGUST 6**

64 The Saturn Nebula

Planetary nebula in Aquarius



THE SATURN NEBULA (NGC 7009) in Aquarius glows with blue-green light. It was the first deep-sky object that German-English astronomer Sir William Herschel discovered, in 1782. DANIEL VERSCHATSE

Sir William Herschel discovered Uranus in 1781 (history's first major planet discovery). It seems fitting, therefore, that the first deep-sky object Herschel discovered also bears a planet's name — the Saturn Nebula. He observed the object September 7, 1782, calling it a "very bright, nearly round planetary disk not well defined."

NGC 7009's common name arises from the thin extensions, or ansae, on either end of the planetary nebula's disk. These extensions resemble Saturn's rings, and astronomers also use the word ansae to describe the apparent connecting points of the rings to the planet. *Ansae* is the Latin word for "handles."

In planetary nebulae, ansae represent material ejected from the nebula in two directions. Astronomers call such objects bipolar planetaries.

When the Saturn Nebula's central star became a white dwarf, it ejected the star's outer layers into space as a cloud of material. In the image (above, right) of the Saturn Nebula, this ejecta forms the circular blue region surrounding the central star.

The spherical region of gas constrains stellar wind from the central star into two jets we see as the ansae.

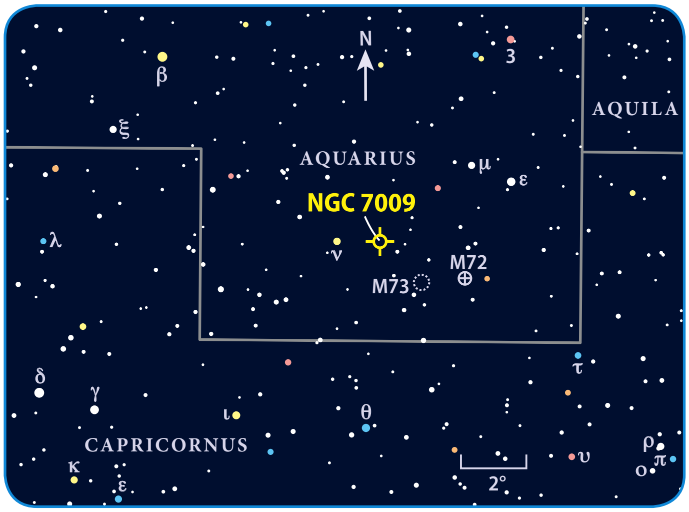
Because of the Saturn Nebula's high surface brightness, any telescope will show some details. The oval disk measures 25" long, and the "rings" extend 15" more from each end. At the end of the extensions lie faint bulbs barely visible at 200x through a 10-inch telescope. Also look for a small, hollow area inside the main disk's fainter shell.

The colors of celestial objects, especially in the green-blue region, are subjective and depend a lot on the observer's eyes. Descriptions of the Saturn Nebula range from green to light blue.

When you're looking for color in planetary nebulae, use direct vision. Looking straight at an object brings your eyes' color-sensitive cones into play. Averted vision, which is best for detecting faint objects, uses the eye's rod cells.

Saturn Nebula statistics

Also known as: NGC 7009 and Caldwell 55
Right ascension: 21h04m
Declination: –11°22'
Magnitude: 8.0
Apparent size: 1.6' by 0.4'
Distance: 2,400 light-years
Visible: South of latitude 78° N.



STAR-HOPPING TO NGC 7009 is no problem. Magnitude 4.5 Nu (ν) Aquarii sits only 1.3° to the east.

JEFF HAPEMAN/ADAM BLOCK/NOAO/AURA/NSF

Look for these celestial targets nearby:

››› **M72,** a magnitude 9.2 globular cluster, lies 2.9° west-southwest.

››› **M73,** a magnitude 8.9 open cluster, lies 1.8° southwest.

››› **NGC 6907,** a magnitude 11.1 spiral galaxy, lies 16.3° south-southwest.

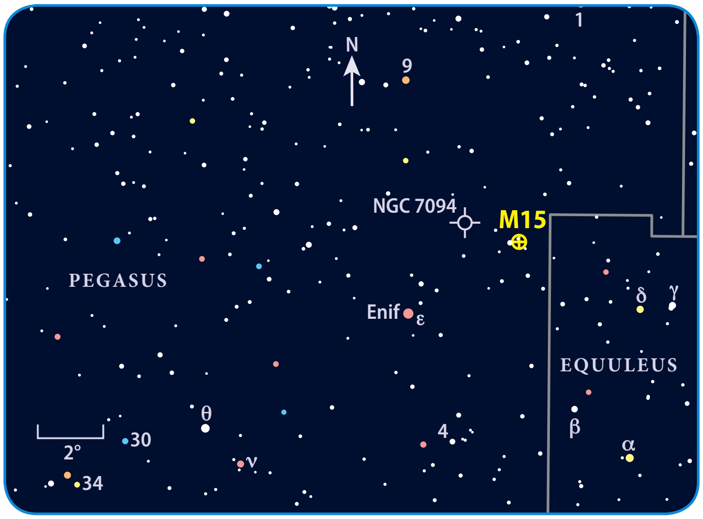
››› **The Aquarius Dwarf,** a magnitude 14.0 dwarf irregular galaxy, lies 4.6° west-southwest.

IF YOU LIKE THIS OBJECT, be sure to observe:
The Eskimo Nebula (NGC 2392) — page 8 • The Owl Nebula (M97) — page 20 • The Ring Nebula (M57) — page 52

BEST SEEN: **AUGUST 13**

65 M15

Globular cluster in Pegasus



TO FIND M15, use Theta (θ) and Epsilon (ε) Pegasi as pointers. Simply draw a line from Theta through Epsilon, and continue another 4°.

Look for these celestial targets nearby:

DANIEL VERSCHATSE

- ››› **M2,** a magnitude 6.6 globular cluster, lies 13° south.
- ››› **NGC 7006,** a magnitude 10.6 globular cluster, lies 8° west-northwest.
- ››› **NGC 7094,** a magnitude 13.4 planetary nebula, lies 1.8° east-northeast.
- ››› **NGC 7177,** a magnitude 11.2 spiral galaxy, lies 9.3° northeast.

GLOBULAR CLUSTER M15 in Pegasus — the sky's 13th-brightest globular — gives off enough light for you to glimpse it with your naked eyes. Don't confuse it with the magnitude 6.1 star SAO 107195, 17' to the east. ADAM BLOCK/NOAO/AURA/NSF

For Northern Hemisphere observers, M15 ranks as autumn's showpiece globular cluster. Overall, it's the sky's 13th-brightest object of this type.

Italian-born French astronomer Jean-Dominique Maraldi (1709–1788) discovered M15 September 7, 1746, on a night he was searching for de Cheseaux's Comet (C/1746 P1). Messier added it to his catalog June 3, 1764. He described it as a, "Nebula without a star; it is round and brilliant in the centre."

From a dark site, sharp-eyed observers can detect M15 with the naked eye. Don't be confused, however, with the magnitude 6.1 star only 17' due east. Confirm your sighting through binoculars or any telescope. Any optical aid will reveal this cluster's fuzzy nature.

A 4-inch telescope will resolve dozens of stars around M15's strikingly bright core. Look for the chains of stars that emanate from the central region. Admiral Smyth wrote, "Although this noble cluster is rated globular, it is not exactly round and under the best circumstances is seen with stragglers branching from the central blaze."

With a 10-inch or larger scope, try for the challenge object within M15 — Pease 1, the first planetary nebula found in a globular cluster. In 1928, American astronomer Francis Gladheim Pease (1881–1938) discovered this object when he noticed an unusually bright "star" on a photograph taken with the 100-inch Hooker Telescope on Mount Wilson.

Look for this planetary nebula through an eyepiece that yields 200x or so. Use a nebula filter. The filter will suppress the brightness of the myriad stars surrounding Pease 1. Be aware of the sky conditions. You'll need good seeing to spot the tiny planetary, which lies about 1' northeast of M15's core. 100

M15 statistics

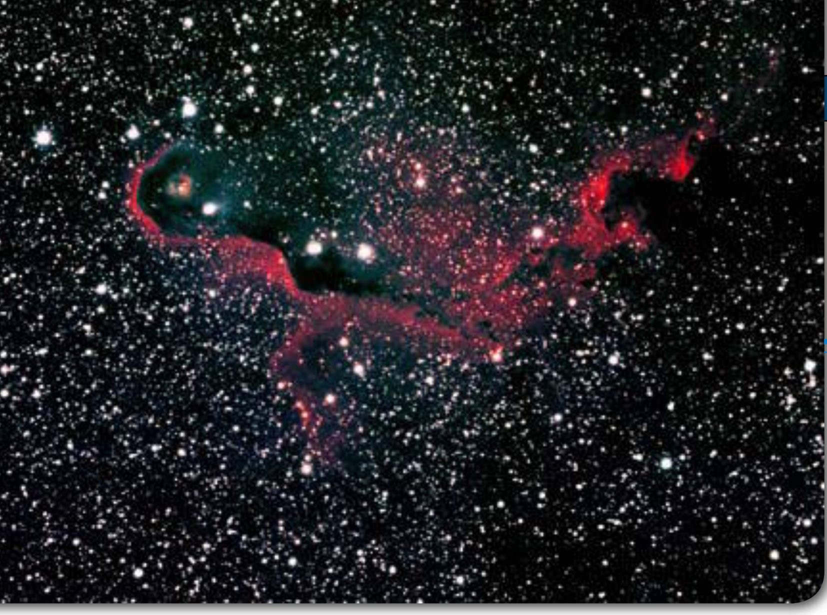
Also known as: NGC 7078
Right ascension: 21h30m
Declination: 12°10'
Magnitude: 6.3
Apparent size: 18'
Distance: 33,600 light-years
Visible: North of latitude 78° S.

IF YOU LIKE THIS OBJECT, be sure to observe:
M4 — page 40 • **M22** — page 48 • **47 Tucanae (NGC 104)** — page 74

BEST SEEN: **AUGUST 15**

66 IC 1396

Open cluster and emission nebula in Cepheus



EMISSION NEBULA IC 1396 in Cepheus measures nearly 3° across and contains the Elephant Trunk Nebula. The bright blue star HD 206267 near the center ionizes IC 1396's gas, causing it to glow red. JOHN CHUMACK

Scanning Cepheus leads us to one of the sky's largest emission nebulae — IC 1396. But this region also contains dark nebulae and a bright cluster. Get ready to spend some time in this area.

In images of IC 1396, the most noticeable part is the aptly named Elephant Trunk Nebula. This region of sinuous bright and dark nebulosity conceals a new star-forming region. Because such regions resemble comets, astronomers have given them the designation cometary globules. In addition to the gas the globules contain, they also sport dusty heads and elongated tails.

By imaging this region in infrared wavelengths, astronomers have found several stars only 100,000 years old. Other, more mature stars produce intense ultraviolet radiation that eats away at the Elephant Trunk's structure.

The brightest star near IC 1396 is Mu (μ) Cephei, also known as Herschel's Garnet Star. This intensely red luminary varies in magnitude from 3.4 to 5.1 over a 730-day period.

Mu is a cool, red supergiant that dredges up carbon compounds from its interior. The carbon temporarily settles on the surface, dimming and reddening the star's light. Eventually, the dark material absorbs enough energy to escape into space. Because of its proximity to Mu, some early 19th-century astronomers referred to

IC 1396 statistics

Right ascension: 21h39m

Declination: 57°30'

Magnitude: 3.5

Apparent size: 170'

Distance: 2,500 light-years

Visible: North of latitude 32° S.

BEST SEEN: **AUGUST 19**

67 The Cocoon Nebula

Emission nebula in Cygnus

Cocoon Nebula statistics

Also known as: IC 5146 and Caldwell 19

Right ascension: 21h53m

Declination: 47°16'

Magnitude: 7.2

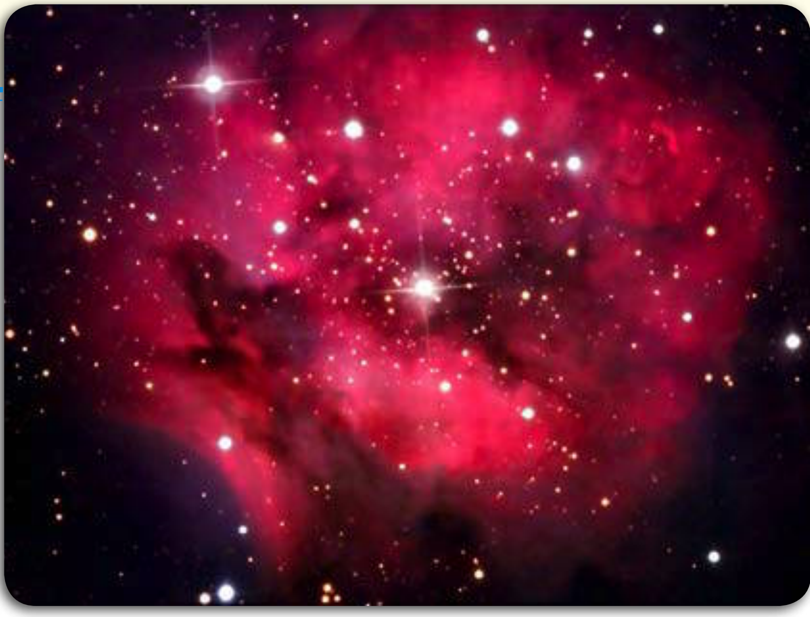
Apparent size: 12'

Distance: 3,000 light-years

Visible: North of latitude 42° S.

Some deep-sky wonders stand on their own. Others pair up with notable companions. Occasionally, the surrounding star field helps elevate a rather ordinary object's status. Such is the case with the Cocoon Nebula.

The Cocoon Nebula overlaps the eastern edge of Barnard 168 (B168), one of the northern sky's finest dark nebulae. From a dark site, sharp-eyed observers can pick up this 1.7°-long, 0.2°-wide murky lane without optical aid, but such a sighting isn't easy. A better approach is to use 50mm or larger binoculars or a telescope with an eyepiece that provides more than a 1° field of view.

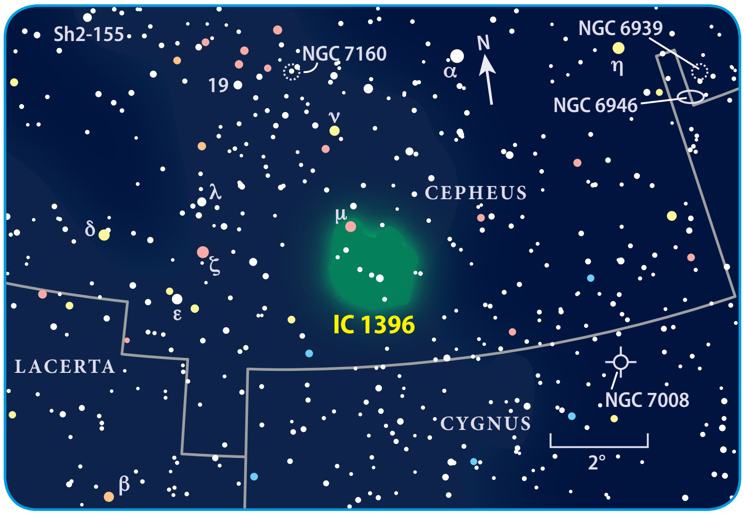


THE COCOON NEBULA (IC 5146) in Cygnus is a star-forming region that includes the nebula and a star cluster that formed from its gas.

JULIE AND JESSICA GARCIA/ADAM BLOCK/NOAO/AURA/NSF

IF YOU LIKE THIS OBJECT, be sure to observe:

The Lobster Nebula (NGC 6357) — page 46 • The Lagoon Nebula (M8) — page 49 • The Rosette Nebula (NGC 2237–9) — page 97



HERSCHEL'S GARNET STAR, an intensely red star also known as Mu (μ) Cephei, is your guide to IC 1396. Through a telescope, star cluster Trumpler 37 will be easier to spot than the nebulous regions of IC 1396.

Look for these celestial targets nearby:

MICHAEL FULLER

››› **NGC 7008,** a magnitude 10.7 planetary nebula, lies 6.1° west-southwest.

››› **NGC 7086,** a magnitude 8.4 open cluster, lies 6° south-southwest.

››› **NGC 7128,** a magnitude 9.7 open cluster, lies 3.8° south-southeast.

››› **NGC 7160,** a magnitude 6.1 open cluster, lies 5.4° north-northeast.

IC 1396 as the Garnet Star Nebula. That name is now obsolete.

If you choose to observe IC 1396 without a nebula filter, use at least a 6-inch telescope from a dark site. Although you'll detect it through smaller instruments, you won't see much detail.

If your telescope's field of view measures at least 2°, you'll see a circular mist crossed by many dark lanes. The most prominent lane points from the nebula's northwestern edge to the center.

At the nebula's heart, you'll find the naked-eye open cluster Trumpler 37, a 1°-wide collection of more than 50 stars between magnitudes 10 and 12. Increase the magnification past 150x to view the triple star at the cluster's center — a magnitude 6 sun flanked by two 8th-magnitude companions. 100

British astronomer Thomas Henry Espinell Compton Espin (1858–1934) discovered the Cocoon Nebula August 13, 1899. German astronomer Maximilian Franz Joseph Cornelius Wolf (1863–1932) was the first to photograph it, in 1900. His description said, "It is placed centrally in a very fine lacuna, void of faint stars, which surrounds the luminous cloud like a trench. The most striking feature with regard to this object is that the star-void halo encircling the nebula forms the end of a long channel ... to a length of more than two degrees."

You can spot the Cocoon Nebula through a 4-inch telescope as a circular blur. Its light equals that of a 7th-magnitude star, but the nebula's surface brightness is low. Making matters worse, two magnitude 9.7 stars lie entangled within the glow. For best results, use at least an 8-inch telescope and an eyepiece equipped with a nebula filter. The filter will suppress the starlight while still passing most of the emission nebula's glow. 100

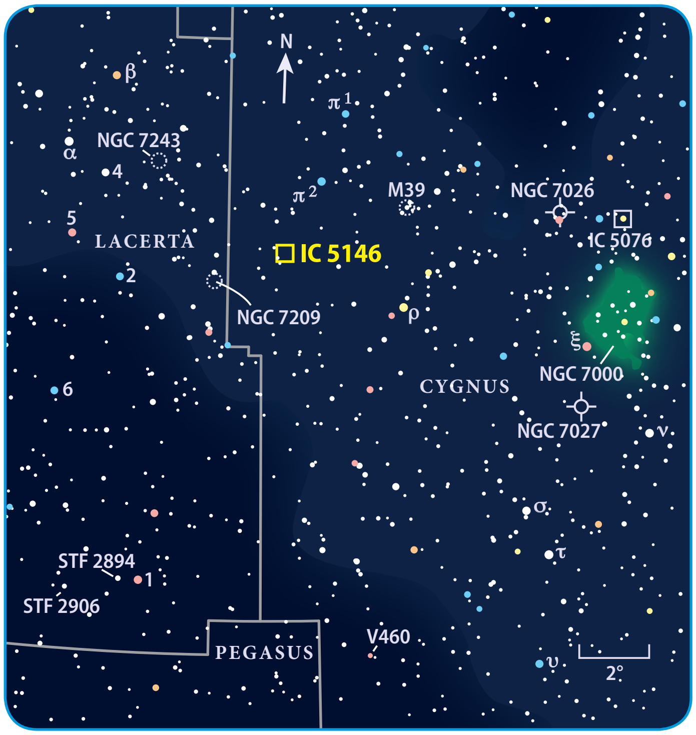
Look for these celestial targets nearby:

››› **NGC 7067,** a magnitude 9.7 open cluster, lies 5° west.

››› **NGC 7245,** a magnitude 9.2 open cluster, lies 7.9° north-northeast.

››› **NGC 7296,** a magnitude 9.4 open cluster, lies 7.5° north-east.

››› **IC 1434,** a magnitude 9.0 open cluster, lies 6.2° north-northeast.



IC 5146 LIES IN A RATHER NONDESCRIPT REGION of Cygnus. Search the area 3.7° east-northeast of 4th-magnitude Rho (ρ) Cygni.

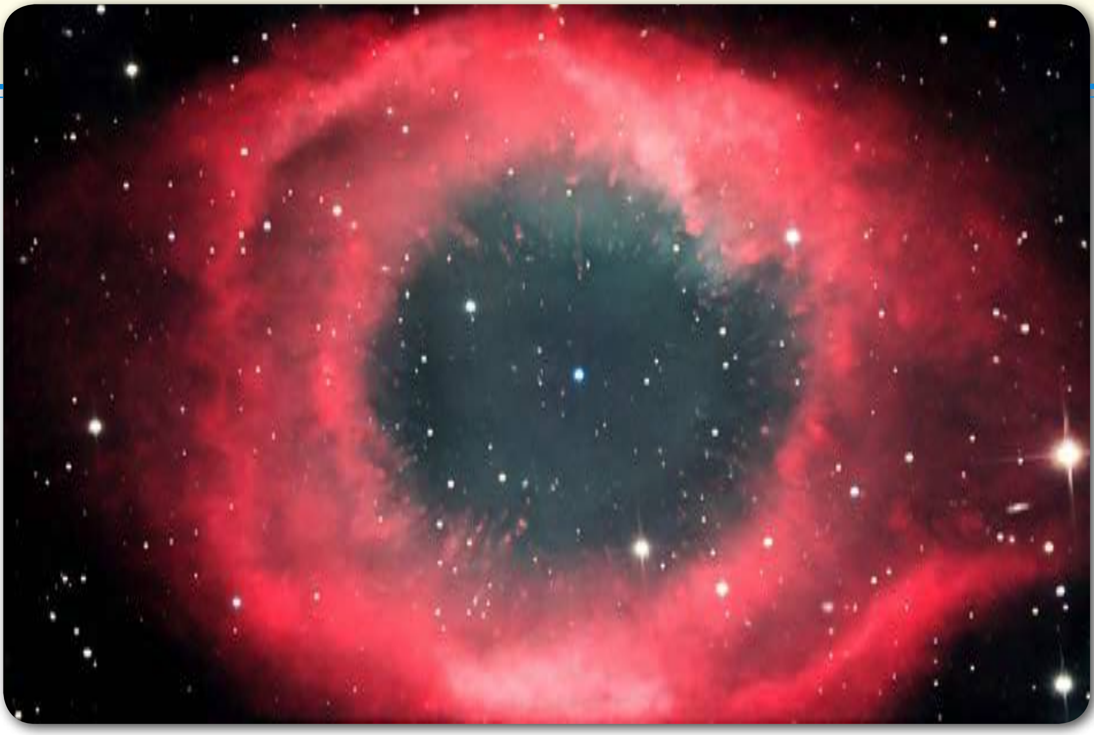
IF YOU LIKE THIS OBJECT, be sure to observe:

The Cat's Paw Nebula (NGC 6334) — page 44 • The Eagle Nebula (M16) — page 49 • The Flame Nebula (NGC 2024) — page 92

BEST SEEN: **AUGUST 29**

68 The Helix Nebula

Planetary nebula in Aquarius



THE HELIX NEBULA (NGC 7293) in Aquarius is the nearest of all planetary nebulae, only 450 light-years away. It appears half as wide as the Full Moon. ADAM BLOCK/NOAO/AURA/NSF

Helix Nebula statistics

Also known as: the Helical Nebula, the Sunflower Nebula, NGC 7293, and Caldwell 63

Right ascension: 22h30m

Declination: –20°48'

Magnitude: 7.3

Apparent size: 20'

Distance: 450 light-years

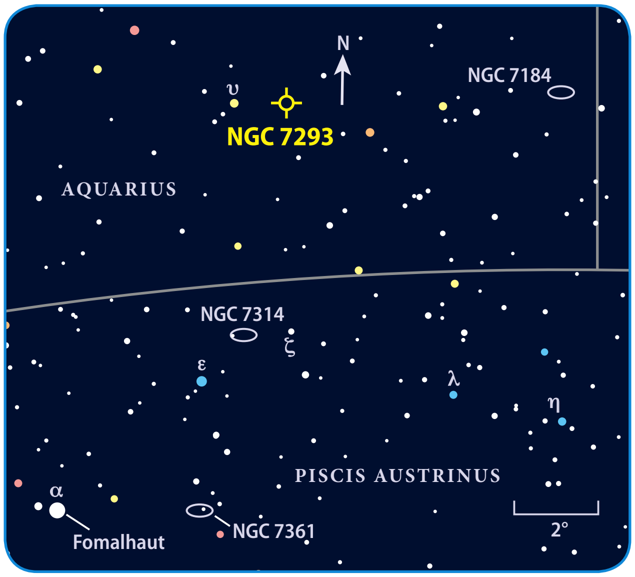
Visible: South of latitude 69° N.

The Helix Nebula is a bright object, but it's hard to see at the same time. Although its total light output nearly reaches 7th magnitude, its surface brightness is disappointingly low. For best results, use binoculars that provide 7x to 15x magnification and have front lenses larger than 50 millimeters.

If your site is dark — and I mean really dark — try to spot the Helix with your naked eyes. I first accomplished this feat at the El Paso Astronomy Club's spectacular dark-sky site, which lies about 50 miles east of El Paso. This location, about 5,000 feet (1,525 meters) above sea level, has some of the best seeing I've experienced. A naked-eye sighting is a bit easier if you first find the Helix through binoculars. Fortunately, no stars of equivalent brightness lie in the Helix's immediate vicinity.

Through 12-inch and larger telescopes, and using a nebula filter, you can pick out brightness differences within the ring. Slightly brighter concentrations lie on the northern and southern edges. Also note that the central "dark" area appears brighter than the background sky outside the ring.

German astronomer Karl Ludwig Harding (1765–1834) published an account of his discovery of the Helix Nebula in the *Berliner Jahrbuch* in 1827. Harding probably found the nebula in 1824 while at Göttingen Observatory. The Helix is the largest and closest planetary nebulae.



NGC 7293 IS AN EASY OBJECT TO SPOT through binoculars. Look 1.2° west of magnitude 5.2 Upsilon (υ) Aquarii. For best views, use a telescope/eyepiece combination that yields about 75x with a nebula or OIII filter.

Look for these celestial targets nearby:

DANIEL VERSCHATSE

- ››› **M30,** a magnitude 6.9 globular cluster, lies 11.7° west-southwest.
- ››› **NGC 7103,** a magnitude 14.3 spiral galaxy, lies 11.7° west-southwest.
- ››› **NGC 7184,** a magnitude 11.1 spiral galaxy, lies 6.3° west.
- ››› **Palomar 12,** a magnitude 12.9 globular cluster, lies 10.1° west.

IF YOU LIKE THIS OBJECT, be sure to observe:
The Eight-burst Nebula (NGC 3132) — page 16 • The Owl Nebula (M97) — page 20 • The Ring Nebula (M57) — page 52

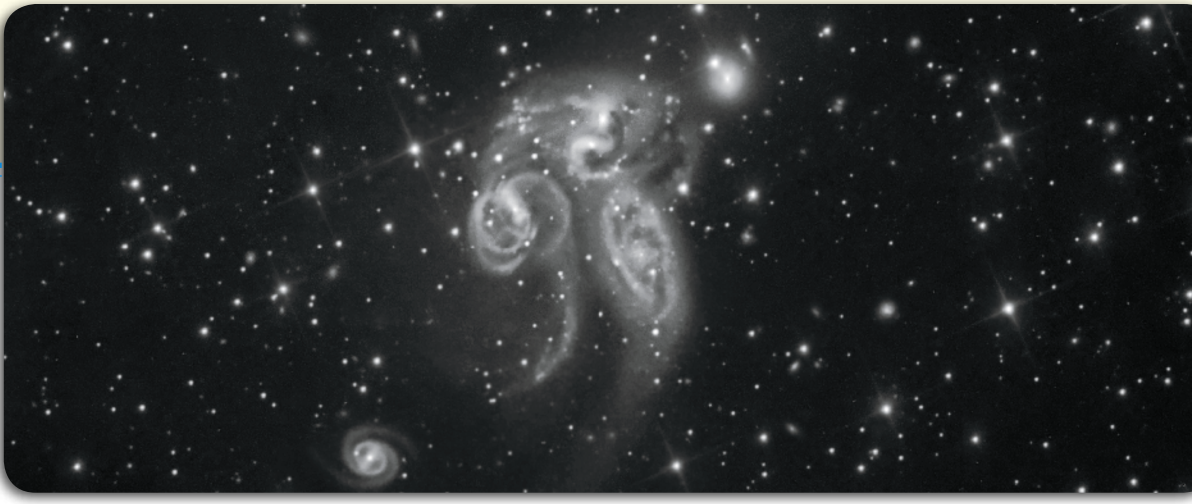
BEST SEEN: **AUGUST 30**

69 Stephan's Quintet

Galaxy group
in Pegasus

Stephan's Quintet statistics

Also known as: NGC 7317, NGC 7318A, NGC 7318B, NGC 7319, and NGC 7320
Right ascension: 22h36m
Declination: 33°58'
Magnitudes: 13.9 to 16.7
Apparent size: 2' to 1'
Distance: 300 million light-years
Visible: North of latitude 56° S.



STEPHAN'S QUINTET (NGC 7317, NGC 7318A, NGC 7318B, NGC 7319, AND NGC 7320) in Pegasus involves five galaxies so close together, they are tearing each other apart. TONY AND DAPHNE HALLAS

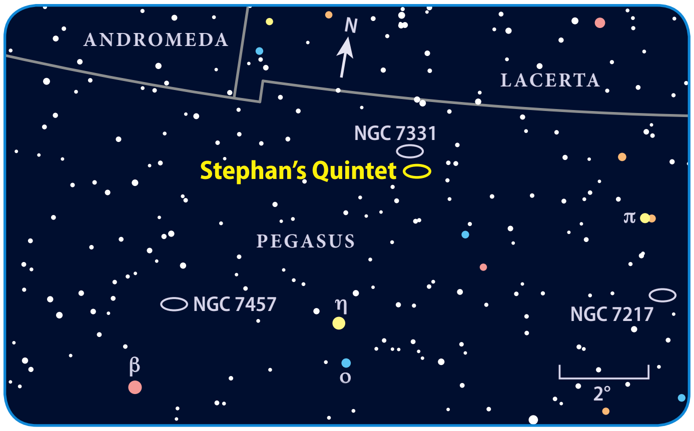
One of the mantras of amateur astronomy is "Aperture rules." This means you'll see more detail as you observe through ever-larger telescopes. None of our 100 wonders illustrates this better than Stephan's Quintet.

French astronomer Édouard Jean-Marie Stephan (1837–1923) discovered this group in 1877. Four of the five galaxies in the Quintet (the exception is NGC 7320) form a compact galaxy group, the first ever discovered. NGC 7320 belongs to the Pegasus Spur, a group of about three dozen galaxies, the brightest of which is NGC 7331 (page 70).

The compact group fascinates astronomers because of the violent collisions among the galaxies. NASA's Spitzer Space Telescope revealed a huge shock wave where NGC 7318B collides with NGC 7318A at millions of miles per hour. Due to this interaction, gas spreads throughout the cluster. This collision can help provide a view into what happened in the early universe, when galaxies lay closer together.

Through a 6-inch scope at 50x, you'll see a clumpy glow covering an area 3' across. A 12-inch telescope will allow you to identify the individual members. At the Quintet's southwestern edge is NGC 7317, which lies next to a 13th-magnitude foreground star. The colliding pair, NGC 7318A and NGC 7318B, lies 2' to the east. Use high magnification to "unmerge" them.

The brightest and largest member, NGC 7320, lies to the southeast and contains a 13th-magnitude foreground star in its halo. This galaxy shines at magnitude 12.5. NGC 7319, which sits at the group's northeastern edge, is the real test for visual observers and is the faintest galaxy in Stephan's Quintet. It glows softly at magnitude 15.3.



STEPHAN'S QUINTET requires a 10-inch or larger telescope and a dark sky to view more than three of its members. Look 4° north-northwest from magnitude 2.9 Matar (Eta [η] Pegasi).

NGC 1 and NGC 2

ANTHONY AYIOMAMITIS

Look for these celestial targets nearby:

- **NGC 1,** a magnitude 12.8 spiral galaxy, lies 20.5° east-southeast.
- **NGC 2,** a magnitude 14.2 spiral galaxy, lies 20.5° east-southeast.
- **NGC 23,** a magnitude 11.9 spiral galaxy, lies 21.8° east-southeast.
- **NGC 108,** a magnitude 12.2 spiral galaxy, lies 23.9° east.

IF YOU LIKE THIS OBJECT, be sure to observe:
Markarian's Chain — page 28 • The Whirlpool Galaxy (M51) — page 37 • The Deer Lick Group (NGC 7331) — page 70

70 The Deer Lick Group

Galaxy group in Pegasus

Pegasus — the seventh-largest constellation — contains many galaxies because it lies outside the Milky Way's glowing band. The finest is NGC 7331, one of autumn's underobserved treats. NGC 7331 ranks as the brightest member in a group of about 35 galaxies called the Pegasus Spur.

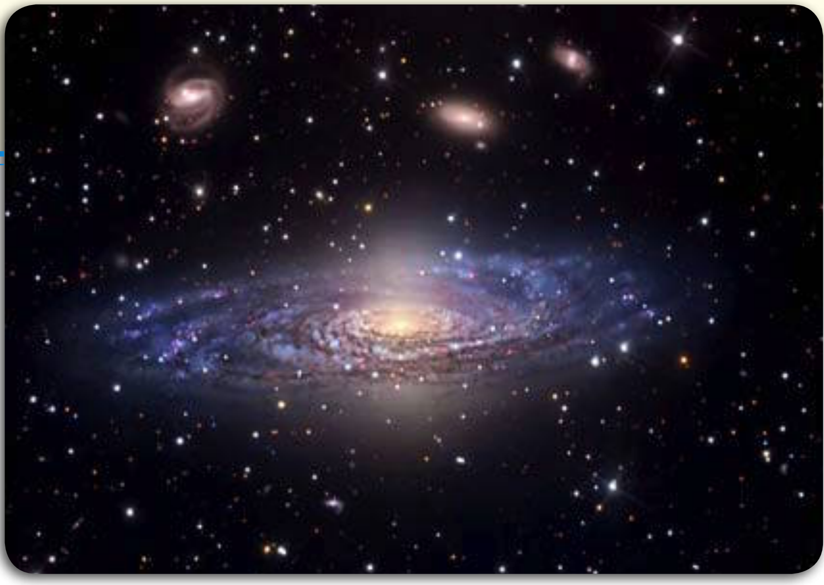
Sir William Herschel discovered NGC 7331 September 5, 1784. He described it as "Very bright, considerably large, much extended. Much brighter in the middle. Resolvable."

American amateur astronomer Tom Lorenzin bestowed the common name on this galaxy group to honor the Deer Lick Gap, which lies in the mountains of North Carolina.

From a dark sky — and with patience — you can spot NGC 7331 through binoculars, but a telescope brings out a lot more detail. Through a 10-inch instrument with a low-power eyepiece, you'll see three galaxies to NGC 7331's east that form an equilateral triangle. These galaxies are not NGC 7331's companions but lie much farther away.

At 200x, the galaxy shows a bright nucleus surrounded by a nebulous glow 3 times as long as it is wide. Larger scopes show the western edge ends abruptly at a dust lane. On nights of good seeing, look for a spiral arm shining beyond this lane.

NGC 7331 was one of 18 galaxies chosen by the Hubble Space Telescope Extragalactic Distance Scale Key Project to refine the cosmic distance scale. This group used Hubble to study Cepheid variable stars, which are superb distance indicators, in each of the selected galaxies. The ultimate goal is to measure the Hubble constant (which tells how fast the universe is expanding at a given distance) to an accuracy of 10 percent. Other galaxies chosen for this study include M81 (page 15), M100 (page 23), and M101 (page 39).



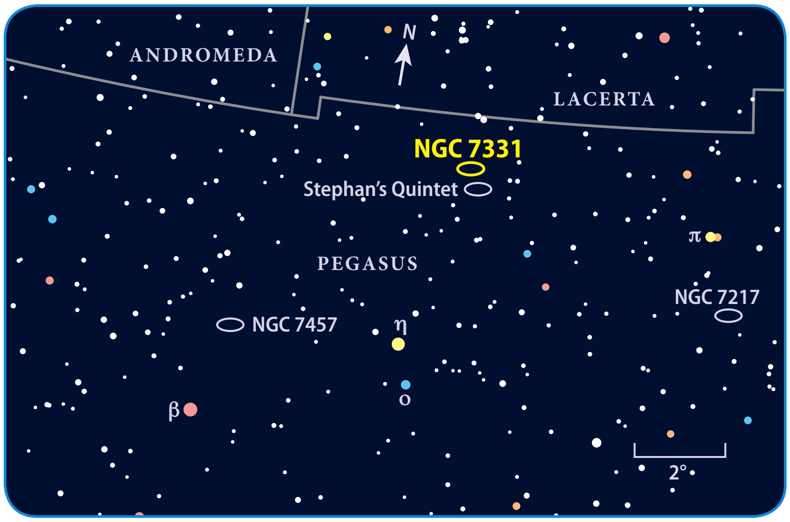
THE DEER LICK GROUP **(NGC 7331) in Pegasus, contains — at magnitude 9.5 — one of the brightest galaxies not in Messier's catalog.** TONY AND DAPHNE HALLAS

Look for these celestial targets nearby:

- ››› **NGC 7426,** a magnitude 12.4 elliptical galaxy, lies 4.3° east-northeast.
- ››› **NGC 7457,** a magnitude 11.0 elliptical galaxy, lies 6.6° southeast.
- ››› **NGC 7678,** a magnitude 11.8 spiral galaxy, lies 16.5° southeast.
- ››› **NGC 7741,** a magnitude 11.0 spiral galaxy, lies 16.6° east-southeast.

Deer Lick Group statistics

Also known as: NGC 7331 (brightest member) and Caldwell 30
Right ascension: 22h37m
Declination: 34°25'
Magnitude: 9.5
Apparent size: 11' by 4'
Distance: 46 million light-years
Visible: North of latitude 55° S.



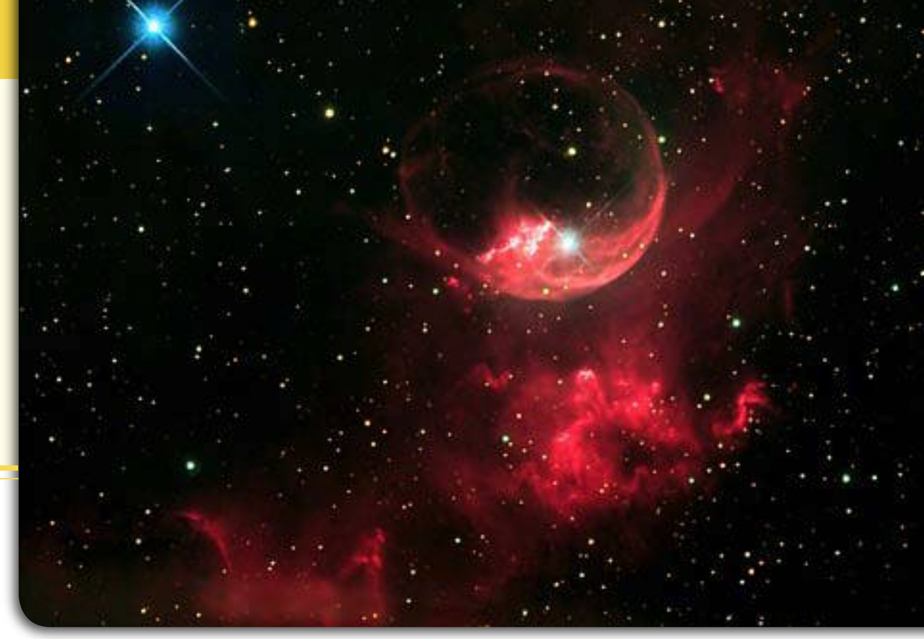
NGC 7331 **is the brightest galaxy in the Deer Lick Group. Amateur astronomer Tom Lorenzin, author of the observing guide *1000+ The Amateur Astronomer's Field Guide to Deep-Sky Observing*, named this group for the Deer Lick Gap in North Carolina's Blue Ridge Mountains.**

IF YOU LIKE THIS OBJECT, be sure to observe:
NGC 2403 — page 10 • NGC 2903 — page 14 • The Southern Pinwheel Galaxy (NGC 300) — page 78

Best seen: **SEPTEMBER 12**

71 The Bubble Nebula

Emission nebula in Cassiopeia



THE BUBBLE NEBULA (NGC 7635) glows because an energetic star at its center emits lots of ultraviolet light. The bubble's shape results from the star's radiation carving a spherical cavity in the gas cloud. BRAD EHRHORN/ADAM BLOCK/NOAO/AURA/NSF

Bubble Nebula statistics

Also known as: NGC 7635 and Caldwell 11

Right ascension: 23h21m

Declination: 61°12'

Magnitude: —

Apparent size: 15'

Distance: 7,800 light-years

Visible: North of latitude 28° S.

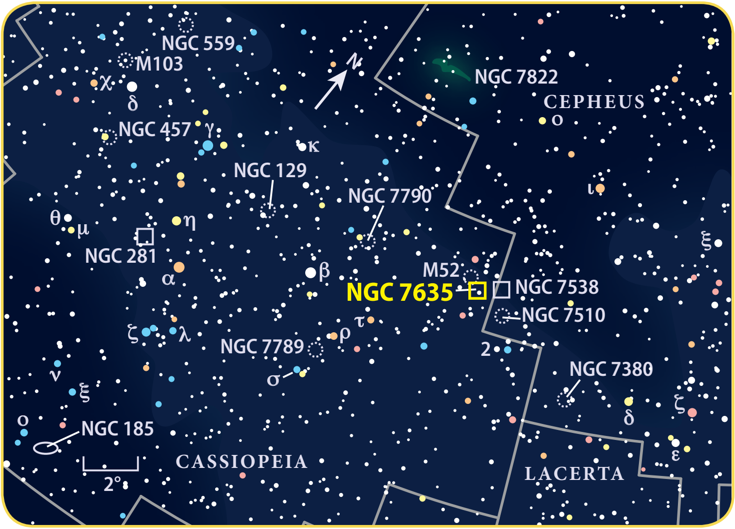
Open cluster M52 serves as a guide to the Bubble Nebula. Observing it will give you a glimpse of how a star interacts with what's around it.

The remarkably spherical bubble marks the boundary between an intense wind of particles from a massive, hot star, BD+602522, and the nebula's interior. The central star is 40 times more massive than the Sun and emits a stellar wind moving at 4 million mph (7 million km/h). The bubble's surface actually marks the leading edge of this wind's gust front, which slows as it plows into the denser surrounding material.

The bubble's surface is not uniform because, as the shell expands, it encounters gaseous regions of different densities that impede the expansion by differing amounts. More material lies to the northeast than to the southwest, so the wind progresses less to the northeast, offsetting the central star from the bubble's center.

Sir William Herschel discovered the Bubble Nebula November 3, 1787. Of it, he wrote, "A star of 9th magnitude with very faint nebulosity of small extent about it." The star measures a magnitude brighter than Herschel's estimate, but his assessment of the nebula was correct — it's faint.

An 8-inch telescope barely shows NGC 7635 as a 3' by 1' arc surrounding the star. This wisp of light floats in a rich field of faint background stars. Through a 16-inch scope, you'll see the whole bubble. Try to detect a fainter haze north of the bright arc and separated from it by a dark lane.



LOOK FOR NGC 7635 0.6° southwest of the binocular open cluster M52 in Cassiopeia. You'll need more than binoculars to view it, however.

Look for these celestial targets nearby:

BILL MARSH

- **M52,** a magnitude 6.9 open cluster, lies 0.6° northeast.
- **NGC 7510,** a magnitude 7.9 open cluster, lies 1.3° west-southwest.
- **NGC 7538,** an emission nebula, lies 0.9° west-northwest.
- **NGC 7788,** a magnitude 9.4 open cluster, lies 4.3° east.

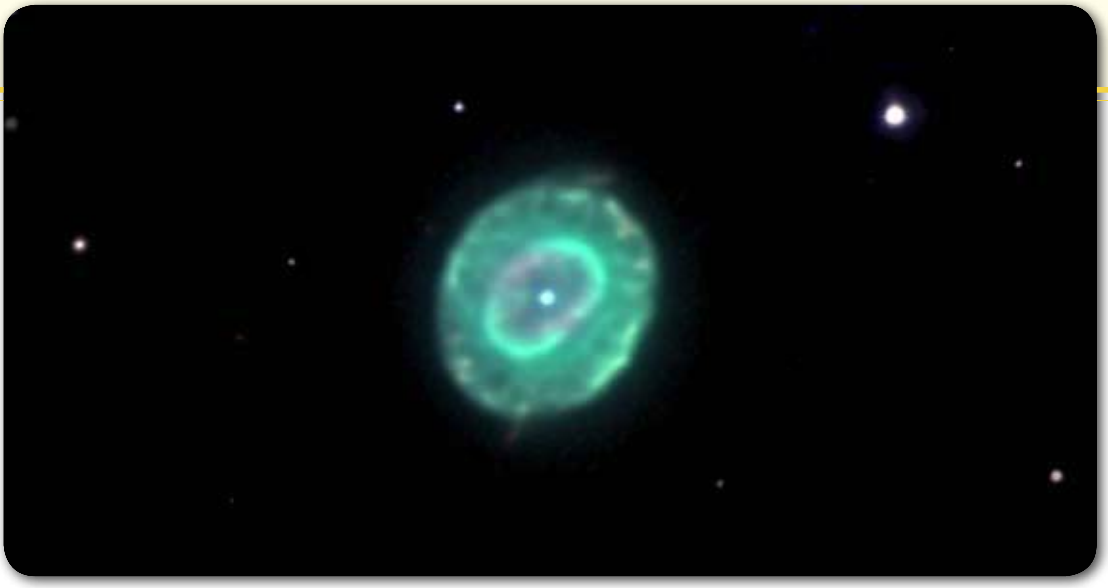
IF YOU LIKE THIS OBJECT, be sure to observe:

Thor's Helmet (NGC 2359) — page 7 • The Crescent Nebula (NGC 6888) — page 58 • The Cone Nebula (NGC 2264) — page 98

Best seen: **SEPTEMBER 13**

72 The Blue Snowball

Planetary nebula in Andromeda



THE BLUE SNOWBALL (NGC 7662) is a planetary nebula in Andromeda whose name is well-earned. Even small telescopes bring out its color. Magnifications between 50x and 100x work best. ADAM BLOCK/NOAO/AURA/NSF

Blue Snowball statistics

Also known as: NGC 7662 and Caldwell 22
Right ascension: 23h26m
Declination: 42°33'
Magnitude: 9
Apparent size: 2.2'
Distance: 2,000 light-years
Visible: North of latitude 47° S.

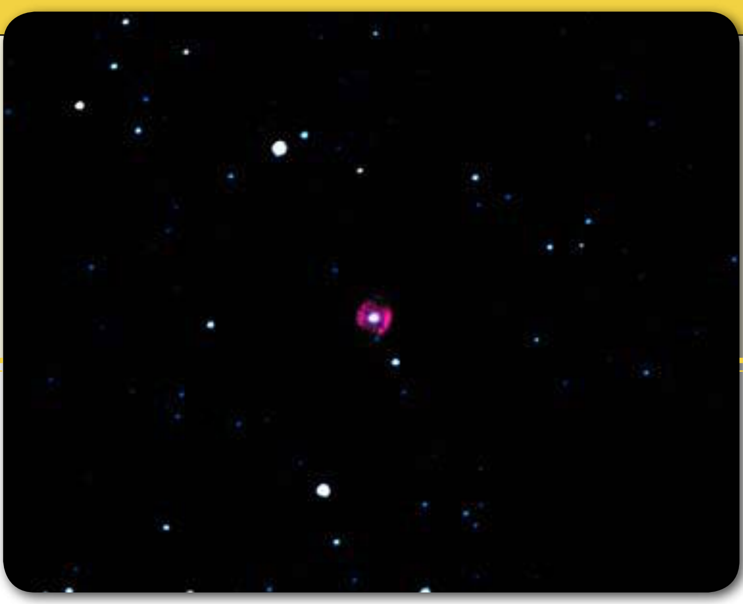
If you're looking for color in a deep-sky object, look no further than the Blue Snowball. Observers have described it as pale blue, faint blue, light blue, Robin's-egg blue, slightly blue, and whitish-blue. You get the picture.

Sir William Herschel discovered NGC 7662 October 6, 1784. His observing notes state, "Bright,

Best seen: **SEPTEMBER 26**

73 The Bow-Tie Nebula

Planetary nebula in Cepheus



THE BOW-TIE NEBULA (NGC 40), a planetary nebula in Cepheus, doesn't give up its secrets easily. Use an 8-inch or larger telescope from a dark site. Within the nebula, the magnitude 11.6 central star looks bright. JACK MARLING

Bow-Tie statistics

Also known as: NGC 40 and Caldwell 2
Right ascension: 0h13m
Declination: 72°32'
Magnitude: 11
Apparent size: 0.6'
Distance: 3,500 light-years
Visible: North of latitude 17° S.

Our most northern celestial wonder sits near the head of Cepheus the King. Despite its low overall magnitude, the Bow-Tie Nebula is a fine target for all scopes because its surface brightness is high.

As is the case with many of our celestial wonders, NGC 40 is a discovery of Sir William Herschel. He found it November 25, 1787.

Magnitude tells observers how bright the object appears. For targets that are not point sources, like galaxies, an integrated magnitude compares all the object's light to the light of a single star. For NGC 40, then, magnitude 11 means its total light output equals that of a magnitude 11 star.

If you combine magnitude with surface brightness, you get a better description of how easily you'll see an astronomical object. Surface brightness is given in units of

IF YOU LIKE THIS OBJECT, be sure to observe:

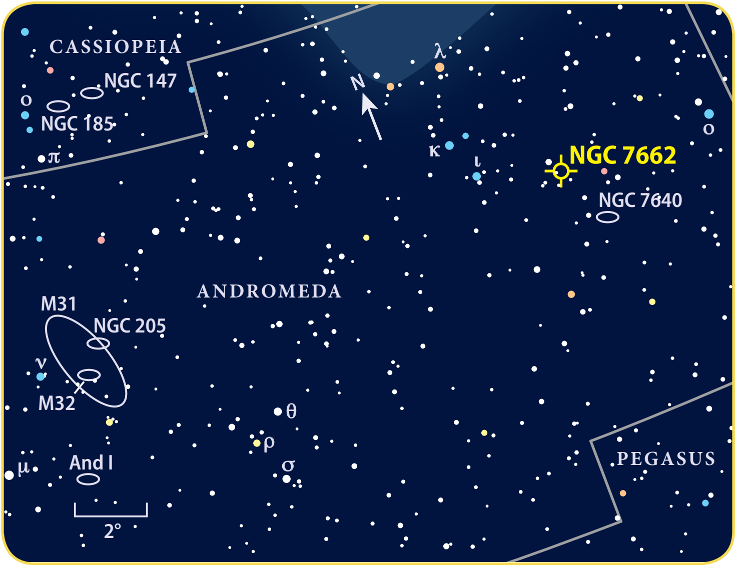
The Ghost of Jupiter (NGC 3242) — page 18 • **The Ring Nebula (M57)** — page 52 • **NGC 6781** — page 54

round, a planetary; pretty well defined disk." A 1960 description by American amateur astronomer Leland S. Copeland gave NGC 7662 its common name.

Through an 8-inch telescope, the Blue Snowball appears as a small, evenly illuminated disk. You won't see the 13th-magnitude central star in telescopes with apertures smaller than about 16 inches, so use your observing time searching for other details, such as the nebula's rich inner structure.

Look for a bright ring of gas surrounding NGC 7662's hollow center. A fainter gas shell, in turn, encompasses the ring. The ring's brightest areas lie to the northeast and southwest. At magnifications above 300x, the brightness of the shell drops quickly near its edge.

Although astronomers have cataloged hundreds of planetary nebulae, exactly how they form is still a hot topic. Add to this the mystery of fast-moving gas clouds that appear around them. Dubbed FLIERs, for Fast Low-Ionization Emission Regions, these dense gas knots predate the planetary nebulae they surround. The central star apparently casts off the FLIERs before forming its shell. Currently, no model accounts for how they form or why they last so long.



TO FIND NGC 7662, start at magnitude 4.3 Iota (ι) Andromedae, and head west to 13 And. Then move 0.4° south-southwest.

Look for these celestial targets nearby:

- ››› **NGC 7209,** a magnitude 7.7 open cluster, lies 14.9° west-northwest.
- ››› **NGC 7243,** a magnitude 6.4 open cluster, lies 14.2° northwest.
- ››› **NGC 7640,** a magnitude 11.1 spiral galaxy, lies 1.8° south-southwest.
- ››› **NGC 7686,** a magnitude 5.6 open cluster, lies 6.6° north.

Astronomers have identified three other planetary nebulae containing FLIERs: the Ghost of Jupiter (page 18), the Blinking Planetary (page 55), and the Saturn Nebula (page 64). 100

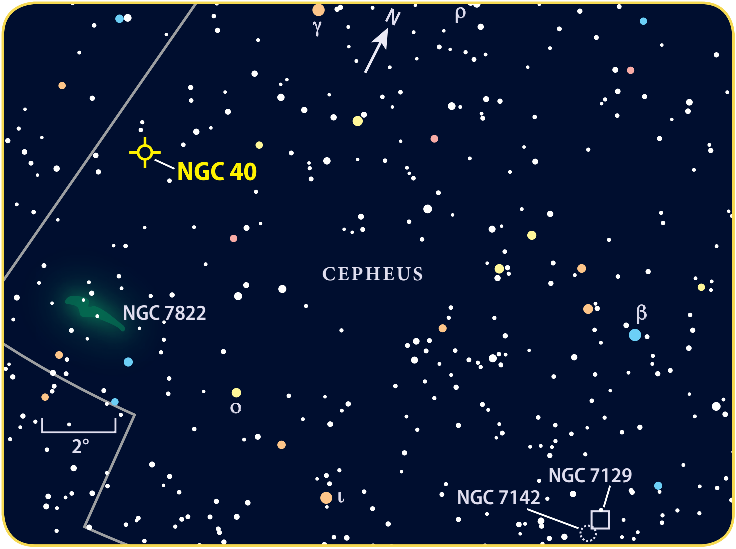
Look for these celestial targets nearby:

- ››› **NGC 188,** a magnitude 8.1 open cluster, lies 12.8° north.
- ››› **NGC 7142,** a magnitude 9.3 open cluster, lies 14.5° west.
- ››› **NGC 7762,** a magnitude 10.0 open cluster, lies 4.9° south.
- ››› **Collinder 463,** a magnitude 5.7 open cluster, lies 7.2° east.

magnitude per square arcsecond. Let's compare NGC 40 with an equally bright galaxy that measures 6' across. Because the galaxy covers an area 100 times greater than NGC 40, its surface brightness is only 1 percent of NGC 40's. So, the Bow-Tie Nebula will be easier to see.

Alaskan amateur astronomer and *Astronomy* contributor Jeff Medkeff has developed a simple rule of thumb to help him determine how difficult a nebula or galaxy will be to see. He multiplies the object's magnitude by its surface brightness. This gives him a number (no units, just a number). The higher that number, the tougher the galaxy will be to observe.

Through a 4-inch telescope at a dark site, you'll see NGC 40's oval disk is about one-third longer than it is wide. A magnification around 100x works best. The magnitude 11.6 central star appears bright compared to the nebula.



NGC 40 LIES IN A DRAB AREA about a degree from the Cassiopeia border. Find the Bow-Tie Nebula 5.3° southeast of magnitude 4.4 Pi (π) Cephei.

Through a 10-inch scope, the Bow-Tie Nebula's disk shows several bright knots lying toward the southeast and northwest. Increase the magnification to 200x (if the seeing permits), and look for a dark cavity between the shell and the central star. 100

IF YOU LIKE THIS OBJECT, be sure to observe:

The Eskimo Nebula (NGC 2392) — page 8 • **The Eight-burst Nebula (NGC 3132)** — page 16 • **The Owl Nebula (M97)** — page 20

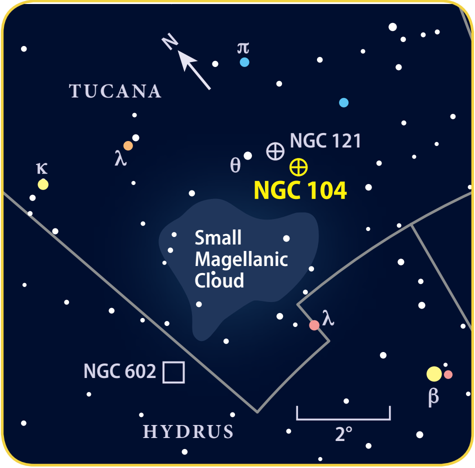
Best seen: **SEPTEMBER 30**

74 47 Tucanae

Globular cluster in Tucana

47 TUCANAE (NGC 104) ranks as the sky's second-brightest globular cluster. Only Omega Centauri (page 36) outshines it. DANIEL VERSCHATSE

ALTHOUGH NGC 104 belongs to the Milky Way, visually, you'll find it off the west-northwest edge of the Small Magellanic Cloud.



One of the sky's greatest celestial pairings occurs in the far southern sky, where 47 Tucanae and the Small Magellanic Cloud (page 77) align. Among globular clusters, only Omega Centauri (page 36) outshines NGC 104, and only Omega appears larger.

Abbé Nicolas Louis de Lacaille discovered NGC 104 and cataloged it on September 14, 1751. Before then, this globular cluster carried the designation of a star: 47 Tucanae.

In his 1879 star catalog *Uranometria Argentina*, American astronomer Benjamin Apthorp Gould (1824–1896) assigned the Greek letter Xi (ξ) to NGC 104. Because Xi appears only in Gould's catalog, astronomers didn't accept this label, and few refer to it today.

To the naked eye, NGC 104 appears as a fuzzy "star." A 3-inch telescope will begin to resolve this cluster's stars, but they really put on a show when you use an 8-inch or larger scope. Through such instruments, the cluster is a ball of stars you can resolve nearly to the core. The 2'-wide core spikes in brightness because of thousands of unresolved stars. Be sure to note the many streams of stars that emanate from a region 6' in diameter.

Most observers consider 47 Tucanae the sky's most impressive globular cluster. The reason involves its stars' evolutionary stage. You can resolve a globular cluster well when you can see the cluster's horizontal branch stars. In a globular cluster where all the stars formed at the same time, the number of stars of a given magnitude takes a sudden leap at a point astronomers refer to as the horizontal branch. That's the stage in a star's life right after its red-giant stage. 47 Tucanae's horizontal-branch magnitude, around 13, makes it easy to resolve.

47 Tucanae statistics

Also known as: NGC 104, Caldwell 106, and Xi Tucanae
Right ascension: 0h24m
Declination: –72°05'
Magnitude: 4.0
Apparent size: 31'
Distance: 13,400 light-years
Visible: South of latitude 17° N.

DANIEL VERSCHATSE

Look for these celestial targets nearby:

- ››› **NGC 121,** a magnitude 10.3 globular cluster, lies 0.6° north-northeast.
- ››› **NGC 330,** a magnitude 9.6 open cluster, lies 2.5° east-southeast.
- ››› **NGC 346,** a magnitude 10.3 open cluster, lies 2.7° east.
- ››› **NGC 362,** a magnitude 6.8 globular cluster, lies 3.3° east-northeast.

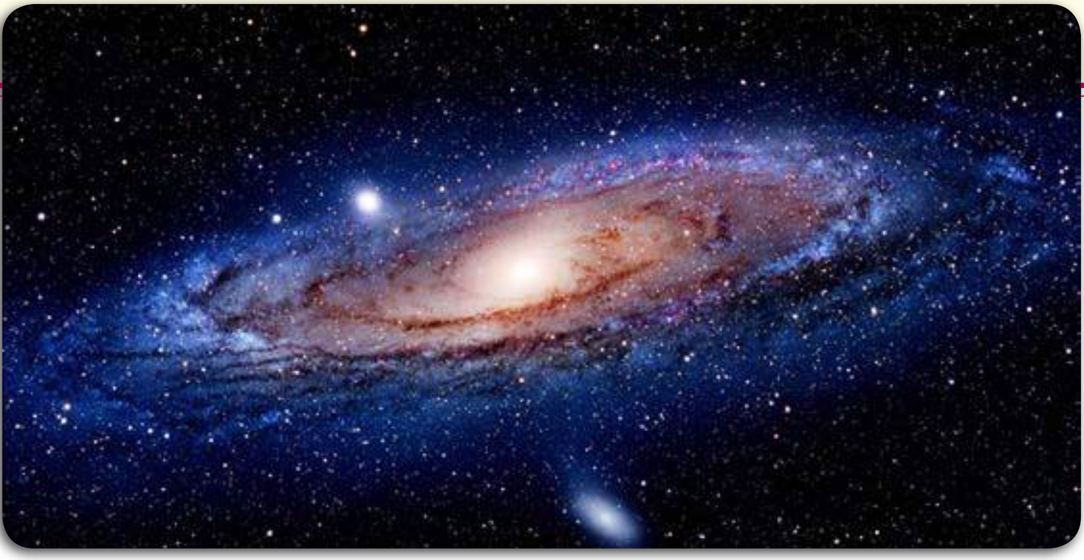
IF YOU LIKE THIS OBJECT, be sure to observe:
Omega Centauri (NGC 5139) — page 36 • **M22** — page 49 • **M15** — page 65

75 The Andromeda Galaxy

Spiral galaxy in Andromeda

Andromeda Galaxy statistics

Also known as: M31 and NGC 224
Right ascension: 0h43m
Declination: 41°16'
Magnitude: 3.4
Apparent size: 180' by 65'
Distance: 2.5 million light-years
Visible: North of latitude 48° S.



THE ANDROMEDA GALAXY (M31) is the Northern Hemisphere's finest galaxy. Whatever size telescope (or binoculars) you use, this object will reward the time you spend observing it. TONY AND DAPHNE HALLAS

The sky's greatest galaxy gets its name from the northern constellation where it resides, Andromeda the Princess. This star system is our nearest large spiral, and it sits at the far end of the Local Group of galaxies.

Observers have described M31 as something other than starlike as far back as 964. In that year, Persian astronomer Abdal-Rahman Al-Sufi called it a "little cloud" in his *Book of Fixed Stars*.

German astronomer Simon Marius (1573–1624) was the first to study the Andromeda Galaxy telescopically. He described it, "Like the flame of a candle seen through horn, and like a cloud consisting of three rays; whitish, irregular and faint; brighter toward the center."

Charles Messier cataloged it as his 31st object August 3, 1764: "The beautiful nebula of the belt of Andromeda, shaped like a spindle; it resembles two pyramids of light, opposed at their bases."

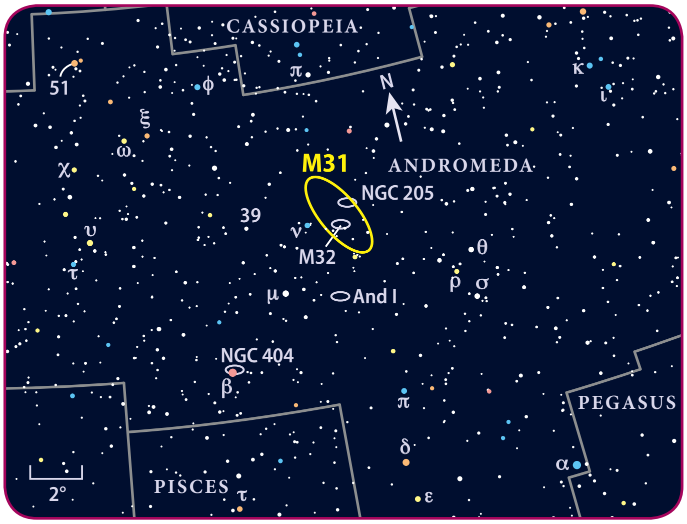
Observers approach the Andromeda Galaxy in one of two ways. Some use low-power optics for an overall view, which includes M31's nucleus, dust lanes, and two companion galaxies, M32 and NGC 205. If this is your approach, use 20x80 (or similar) binoculars from a dark observing location. Try to trace M31's full length, which equals 6 Full Moons side by side.

Other amateur astronomers eschew wide-field views of the Andromeda Galaxy in favor of greatly magnified looks at small regions through large telescopes. If this plan appeals to you, use a 10-inch or larger scope and crank up the magnification to 300x and more. Scan M31's spiral arms for bright clumps, which indicate star-forming regions. A nebula filter will enhance these areas.

ADAM BLOCK/NOAO/AURA/NSF

Look for these celestial targets nearby:

- ››› **M32,** a magnitude 8.1 elliptical galaxy, lies 0.4° south.
- ››› **NGC 185,** a magnitude 9.3 elliptical galaxy, lies 7.1° north.
- ››› **NGC 205,** a magnitude 7.9 elliptical galaxy, lies 0.6° northwest.
- ››› **NGC 404,** a magnitude 10.0 elliptical galaxy, lies 7.6° southeast.



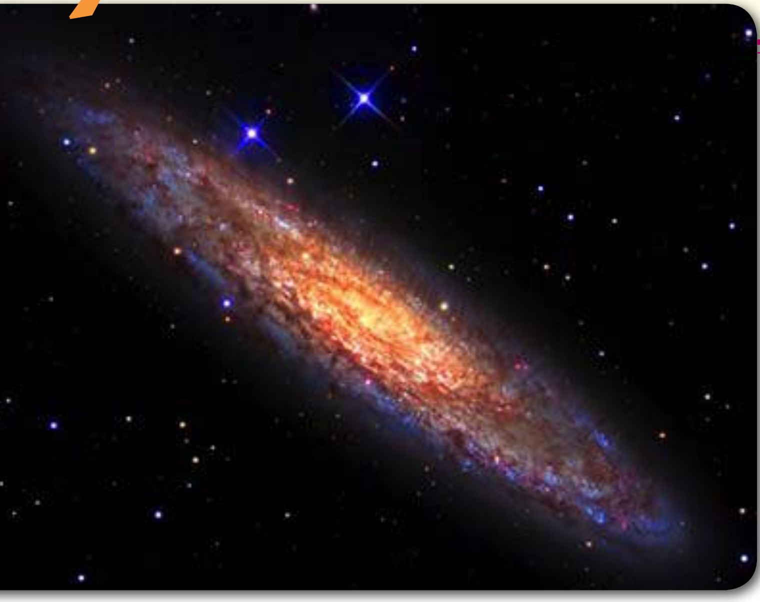
TEST YOUR VISION and your sky's darkness and transparency by trying to spot the Andromeda Galaxy (M31) with your naked eyes.

IF YOU LIKE THIS OBJECT, be sure to observe:
The Sombrero Galaxy (M104) — page 27 • The Whale Galaxy (NGC 4631) — page 29 • The Pinwheel Galaxy (M33) — page 80

BEST SEEN: **OCTOBER 6**

76 The Silver Coin Galaxy

Spiral galaxy in Sculptor



THE SILVER COIN GALAXY **(NGC 253) in Sculptor, at magnitude 7.6, is one of the brightest galaxies beyond the Local Group, which includes the Milky Way and Andromeda galaxies.** R. JAY GaBANY

The Silver Coin Galaxy makes every observer's top 10 list of galaxies. It's that good. This object's "fame quotient" is low, however, because from northern sites it lies low in the south. That, and Charles Messier didn't observe it.

British amateur astronomer Caroline Herschel (1750–1848), sister of Sir William Herschel, discovered NGC 253 September 23, 1783. Sir William added it to his catalog October 30. He wrote, "Considerably bright, much extended, from south preceding to north following."

The Silver Coin Galaxy — so named because of its appearance through small telescopes — is visible to sharp-eyed observers from a dark, southerly site. From the Northern Hemisphere, it's best to conduct this test of vision and sky quality when NGC 253 lies at its highest point.

Silver Coin Galaxy statistics

Also known as: the Sculptor Galaxy, NGC 253, and Caldwell 65

Right ascension: 0h48m

Declination: –25°17'

Magnitude: 7.1

Apparent size: 25' by 7'

Distance: 10 million light-years

Visible: South of latitude 64° N.

BEST SEEN: **OCTOBER 8**

77 The Small Magellanic Cloud

Irregular galaxy in Tucana

Small Magellanic Cloud statistics

Also known as: the SMC, Nubecula Minor, and NGC 292

Right ascension: 0h53m

Declination: –72°50'

Magnitude: 2.3

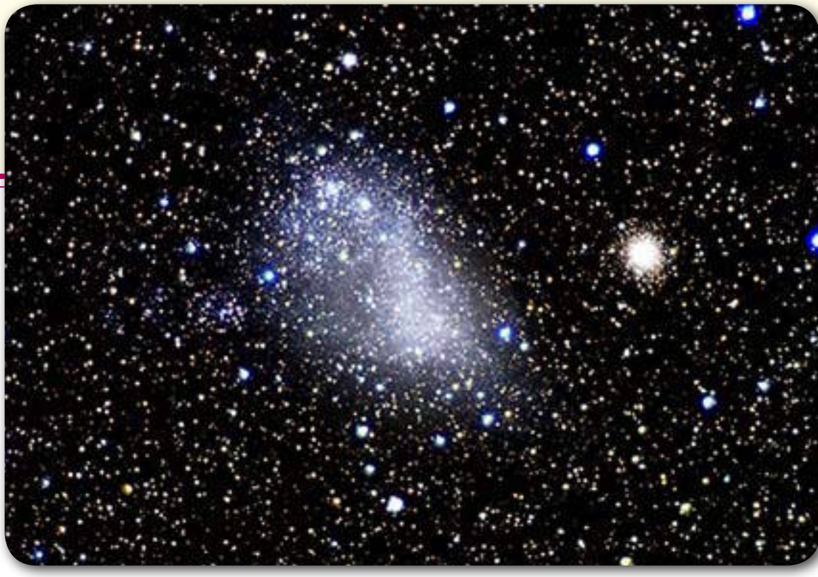
Apparent size: 280' by 160'

Distance: 210,000 light-years

Visible: South of latitude 17° N.

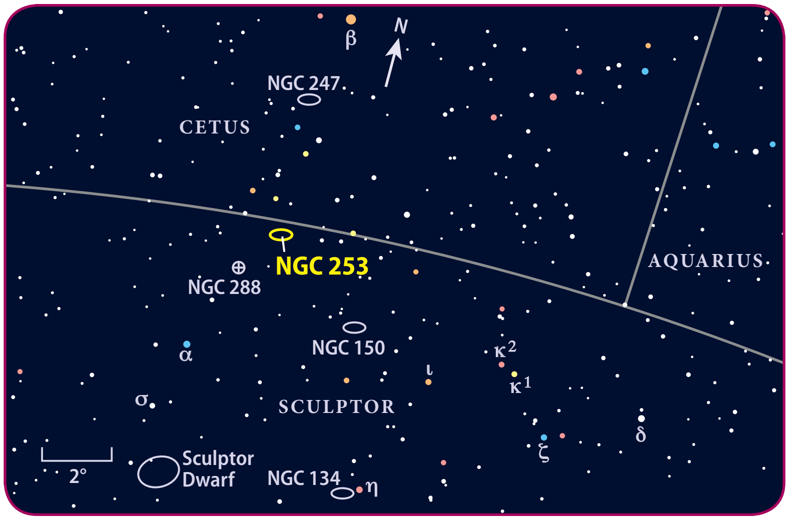
The sky's second-largest galaxy has the word "small" in its name only because its counterpart, the Large Magellanic Cloud (page 90), appears larger.

Historians often credit Portuguese explorer Ferdinand Magellan (1480–1521) with the discovery of these objects, but that is incorrect. The SMC and the LMC had been visible to Southern Hemisphere dwellers throughout history. What Magellan did was to make both "clouds" known to Europe; thus, they bear his name.



THE SMALL MAGELLANIC CLOUD **in Tucana is one of the Milky Way's satellite galaxies. Along with its counterpart, the Large Magellanic Cloud (page 90), it's one of the southern sky's brightest objects. The globular cluster near the SMC is 47 Tucanae (page 74).** DANIEL VERSCHATSE

IF YOU LIKE THIS OBJECT, be sure to observe:
Bode's Galaxy (M81) — page 15 • The Sunflower Galaxy (M63) — page 34 • The Deer Lick Group (NGC 7331) — page 70



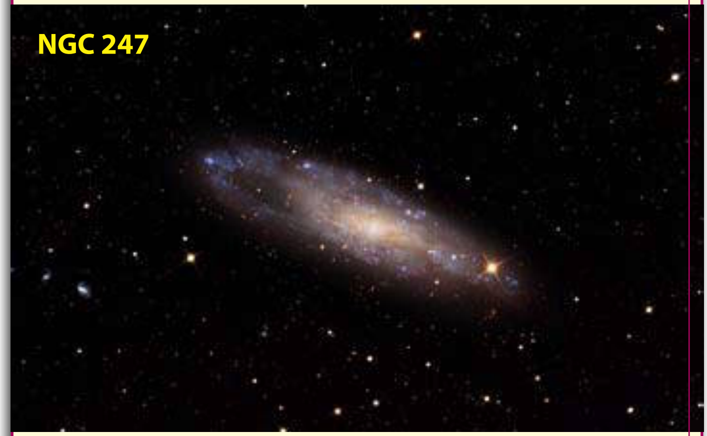
SOME KEEN-EYED OBSERVERS have spotted NGC 253 without optical aid. To try this, look 4.8° north-northwest of magnitude 4.3 Alpha (α) Sculptoris.

NGC 253 belongs to the Sculptor Group of galaxies, the closest such system to our Local Group. This collection also includes NGC 55, NGC 247, and NGC 300 (page 78).

Through an 8-inch or larger telescope, you'll see the galaxy's mottled appearance. Although the core is well-defined, it's only slightly brighter than NGC 253's arms. Dark dust lanes radiate from the center. Use a 12-inch scope to discern the spiral arms, one to the northeast and one to the southwest.

Look for these celestial targets nearby:

NGC 247



DANIEL VERSCHATSE

››› **NGC 150,** a magnitude 11.2 spiral galaxy, lies 3.9° southwest.

››› **NGC 247,** a magnitude 8.9 spiral galaxy, lies 4.5° north.

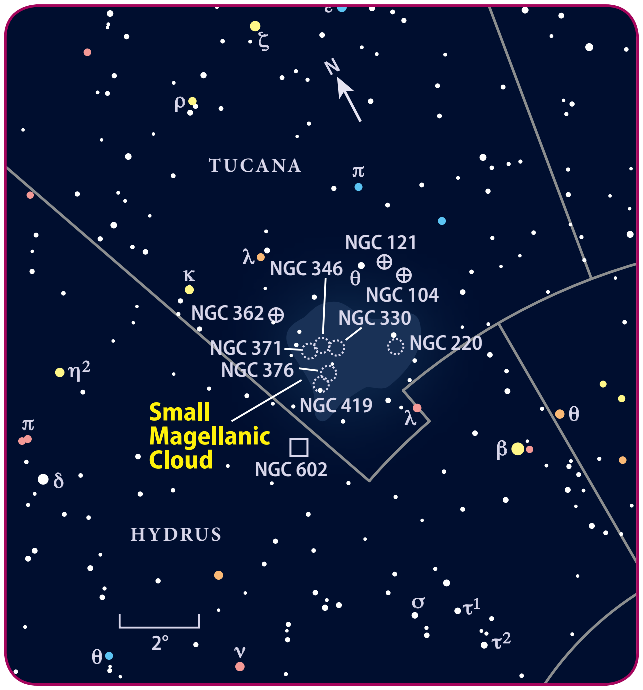
››› **NGC 288,** a magnitude 8.1 globular cluster, lies 1.8° southeast.

››› **NGC 613,** a magnitude 9.9 spiral galaxy, lies 11.2° east-southeast.

To the naked eye, the SMC appears 50-percent longer than it is wide, oriented on a northeast-southwest line. The central region and a 1°-wide area on the galaxy's northeastern end look brightest.

After you've observed the SMC with your naked eyes and then through binoculars, point your telescope at this wondrous object — and the bigger the scope, the better. The SMC contains no less than two dozen NGC objects brighter than magnitude 12.6.

Harvard College astronomer Henrietta Swan Leavitt (1868–1921) first noticed something was going on with Cepheid variable stars in this galaxy. She found a relationship between the brightnesses of Cepheids and the rates at which they brighten and dim. Astronomers now use them as "standard candles" to determine galactic distances.



YOU'LL FIND MANY NGC OBJECTS within the Small Magellanic Cloud. Go slowly, and try to identify the six shown here.

Look for these celestial targets nearby:

››› **NGC 371,** an open cluster, lies 1.1° northeast.

››› **NGC 376,** a magnitude 10.9 open cluster, lies 0.8° east.

››› **NGC 419,** a magnitude 11.2 open cluster, lies 1.2° east.

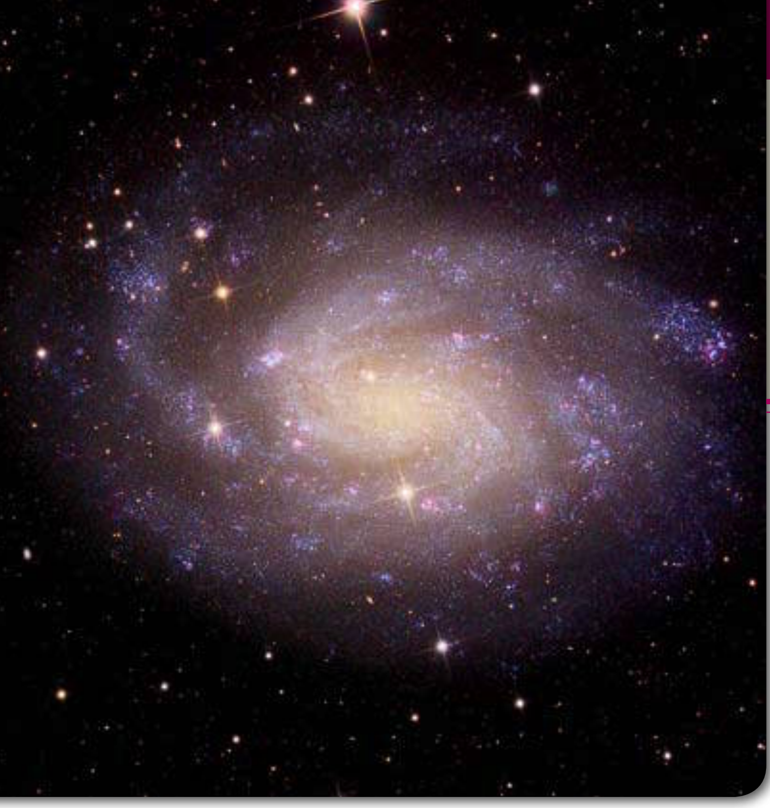
››› **NGC 465,** a magnitude 11.5 open cluster, lies 1.8° east-southeast.

IF YOU LIKE THIS OBJECT, be sure to observe:
The Sombrero Galaxy (M104) — page 27 • Barnard's Galaxy (NGC 6822) — page 56 • The Large Magellanic Cloud — page 90

BEST SEEN: **OCTOBER 8**

78 The Southern Pinwheel Galaxy

Spiral galaxy in Sculptor



THE SOUTHERN PINWHEEL GALAXY (NGC 300) in Sculptor is large and has loosely wound arms and a low surface brightness, just like its northern namesake, M33, in Triangulum. DANIEL VERSCHATSE

Perhaps the sky's most classic spiral galaxy inhabits a region in southeastern Sculptor. Along with the Silver Coin Galaxy (page 76), NGC 300 creates interest in a constellation whose brightest star glows at a feeble magnitude 4.3.

James Dunlop discovered the Southern Pinwheel Galaxy. He made it number 530 (out of 629 entries) in *A Catalogue of Nebulae and Clusters of Stars in the Southern Hemisphere observed in New South Wales*. Dunlop published this catalog in the *Philosophical Transactions of the Royal Society*, Vol. 118, 1828.

One glance at NGC 300 through an 8-inch telescope, and you'll know why it's called the Southern Pinwheel Galaxy. The resemblance to M33 (page 80) is uncanny. NGC 300 has low surface brightness and a broadly concentrated central region that stretches nearly one-third of this galaxy's length. The core, however, appears small, almost starlike.

Through 12-inch and larger scopes, examine NGC 300's two prominent spiral arms for dark lanes. Use a nebula filter to observe the bright spots signaling star-forming regions. Several foreground stars superimposed over the galaxy complete the picture.

Southern Pinwheel Galaxy statistics

Also known as: NGC 300 and Caldwell 70

Right ascension: 0h55m

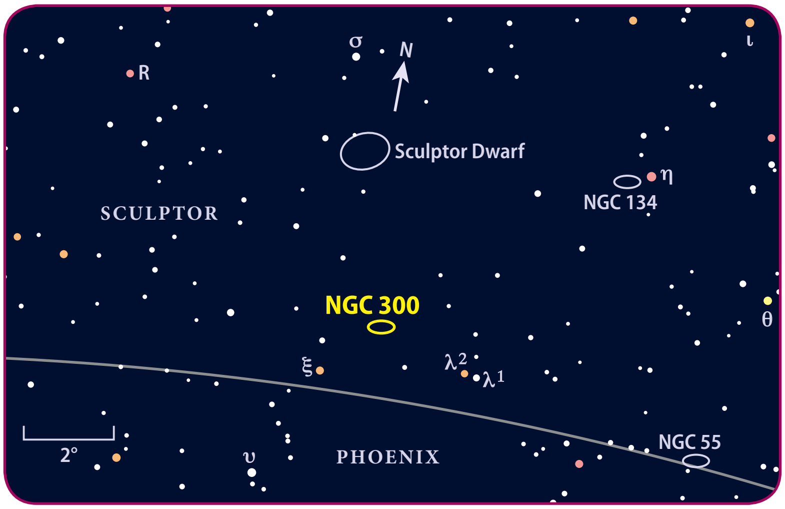
Declination: –37°41'

Magnitude: 8.1

Apparent size: 19' by 13'

Distance: 6 million light-years

Visible: South of latitude 52° N.



NGC 300 SITS IN SOUTHERN SCULPTOR nearly halfway from the celestial equator to the South Celestial Pole, so northern observers may have trouble finding it. It forms the top of a triangle with Xi (ξ) and Lambda² (λ²) Sculptoris.

Look for these celestial targets nearby:

DANIEL VERSCHATSE

››› **The Southern Cigar Galaxy** (NGC 55), a magnitude 7.8 spiral galaxy, lies 7.9° west-southwest.

››› **NGC 134,** a magnitude 10.4 spiral galaxy, lies 6.7° northwest.

››› **NGC 630,** a magnitude 11.9 elliptical galaxy, lies 8.1° east-southeast.

››› **NGC 7793,** a magnitude 9.0 spiral galaxy, lies 12.7° west-northwest.

IF YOU LIKE THIS OBJECT, be sure to observe:
The Whirlpool Galaxy (M51) — page 37 • M101 — page 39 • The Pinwheel Galaxy (M33) — page 80

BEST SEEN: **OCTOBER 15**

79 The Owl Cluster

Open cluster in Cassiopeia

The second of our celestial owls (see the Owl Nebula on page 20) takes silent flight in Cassiopeia's rich star fields. Magnitude 5 Phi (ϕ) Cassiopeiae lends its name to the cluster but doesn't travel with it through space.

Sir William Herschel discovered NGC 457 October 18, 1787. Charles Messier missed this cluster, although it outshines the two objects he included in his list from this constellation — magnitude 6.9 M52 and magnitude 7.4 M103.

While observing this open star cluster in 1977, current *Astronomy* Editor David J. Eicher saw an owl figure made of the two brightest stars and the overall shape. He dubbed it the Owl Cluster.

NGC 457 contains 25 stars brighter than 12th magnitude. Its most luminous star shines at magnitude 8.6. A 6-inch telescope at 50x shows nearly 75 cluster stars. Note the uniform background glow caused by distant, unresolved Milky Way stars.

Owl Cluster statistics

Also known as: the Phi Cassiopeiae Cluster, the E.T. Cluster, NGC 457, and Caldwell 13

Right ascension: 1h20m

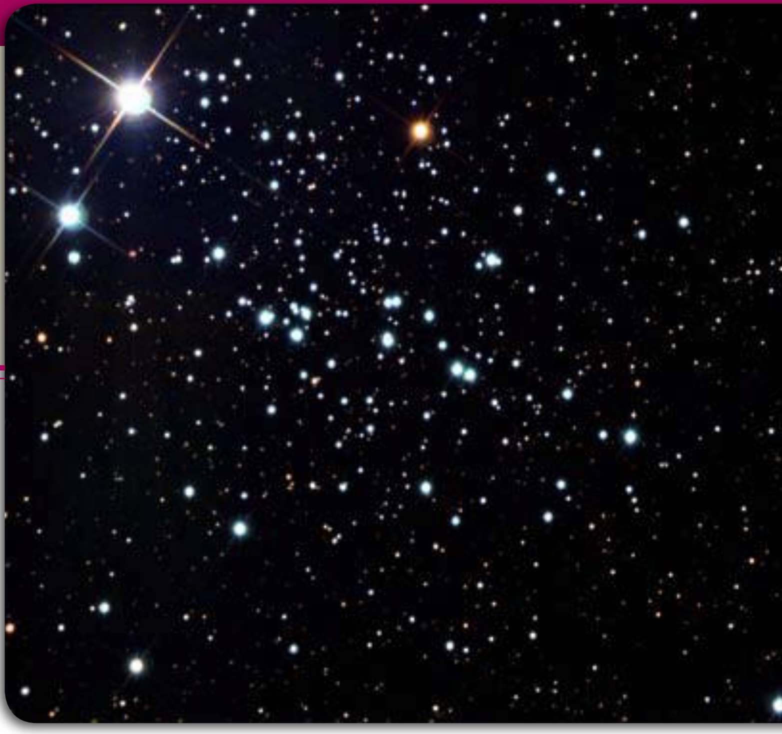
Declination: 58°17'

Magnitude: 6.4

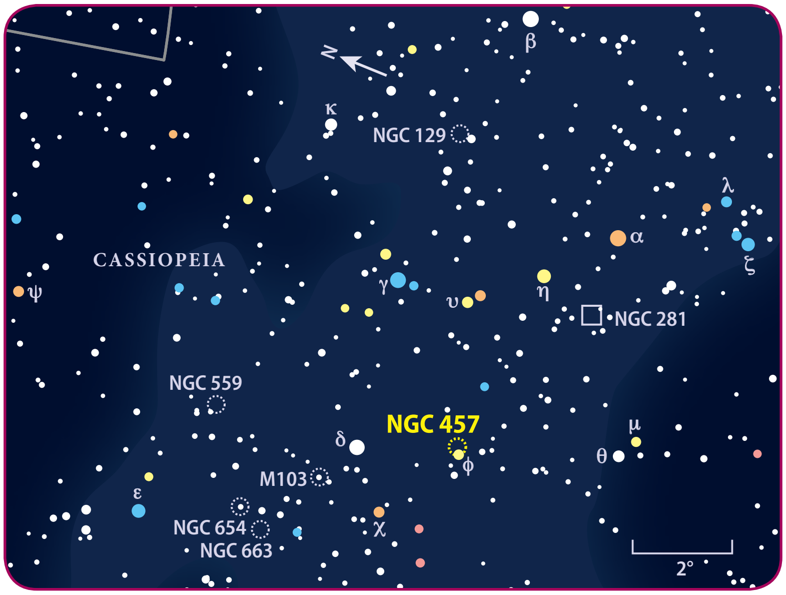
Apparent size: 20'

Distance: 8,000 light-years

Visible: North of latitude 31° S.



THE OWL CLUSTER LOOKS LIKE A BIRD to observers. Two stars on each edge form the "wings." KEN AND EMILIE SIARKIEWICZ/ADAM BLOCK/NOAO/AURA/NSF



NGC 457 inhabits a rich Milky Way area in Cassiopeia. Find it 2.1° south-southwest of magnitude 2.7 Delta [δ] Cassiopeiae.

Look for these celestial targets nearby:

ADAM BLOCK/NOAO/AURA/NSF

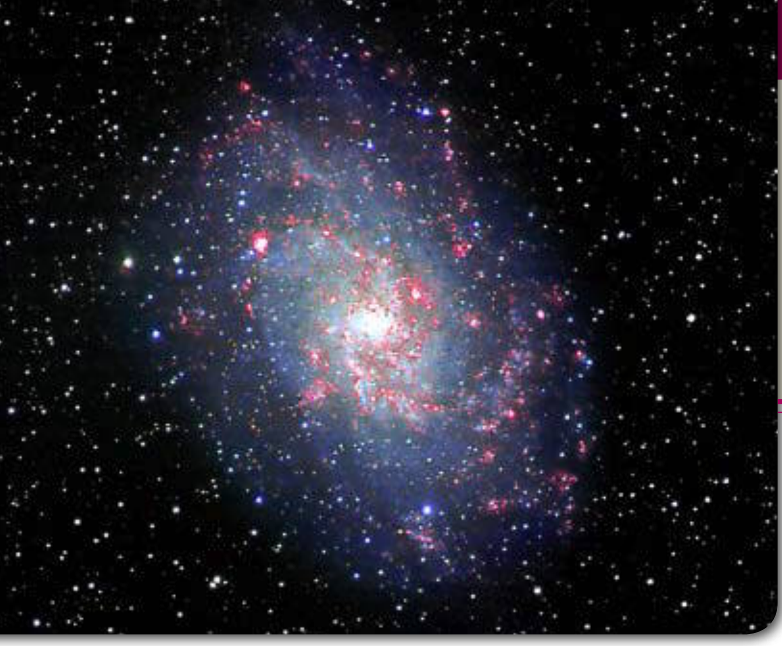
- ››› **M76,** a magnitude 10.1 planetary nebula, lies 7.5° south-southeast.
- ››› **M103,** a magnitude 7.4 open cluster, lies 2.9° north-east.
- ››› **NGC 129,** a magnitude 6.5 open cluster, lies 6.6° west-northwest.
- ››› **The Pac-Man Nebula (NGC 281),** an emission nebula, lies 4° west-southwest.

IF YOU LIKE THIS OBJECT, be sure to observe:
M41 — page 6 • The Beehive Cluster (M44) — page 12 • The Northern Jewel Box (NGC 6231) — page 43

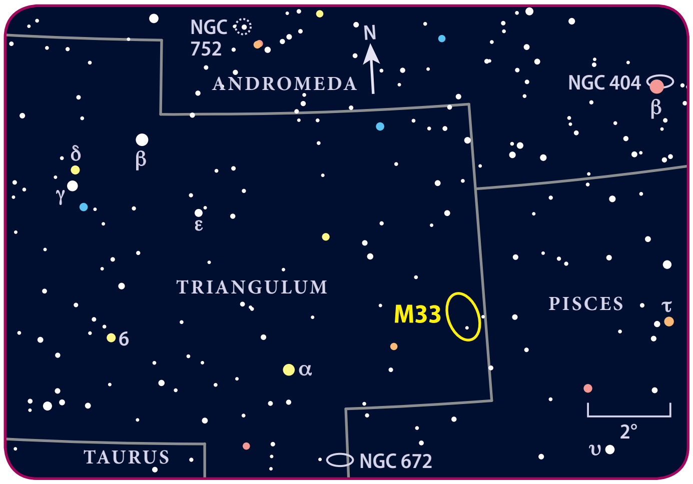
BEST SEEN: **OCTOBER 19**

80 The Pinwheel Galaxy

Spiral galaxy in Triangulum



THE PINWHEEL GALAXY (M33) in Triangulum is more difficult to observe than its magnitude 5.7 brightness indicates. Because its orientation is face-on, M33's light spreads out over a large area. PAOLO CANDY



M33 LIES IN A RICH FIELD OF STARS 0.5° from the Pisces border. M33 sits 4° west-northwest of magnitude 3.4 Alpha (α) Trianguli.

Pinwheel Galaxy statistics

Also known as: the Triangulum Galaxy, M33, and NGC 598

Right ascension: 1h34m

Declination: 30°39'

Magnitude: 5.7

Apparent size: 73' by 45'

Distance: 3 million light-years

Visible: North of latitude 59° S.

Triangulum the Triangle would be easy to miss except that it contains one of the sky's standout galaxies. The Pinwheel Galaxy (M33) offers targets within its borders that the constellation lacks. Be prepared to spend lots of time observing this wonder.

Giovanni Hodierna probably observed M33 before 1654. Charles Messier independently discovered it August 25, 1764: "The nebula is a whitish light of almost even brightness. However, along two-thirds of its diameter it is a little brighter. Contains no star. Seen with difficulty in a 1-foot telescope."

Although you can glimpse M33 with your naked eyes from a dark site, this galaxy covers more than 1° of sky, so its surface brightness is low. Binoculars and small telescopes will help you gauge its overall shape, but you'll want to do a lot better than that. The best approach is to observe M33 through a 10-inch or larger telescope.

At 50x, look for an S shape emanating from a slightly brighter center. Luminous knots around M33's main body are vast star-forming regions. Through a 12-inch or (preferably) larger scope, find emission nebula NGC 604, which sits at the tip of M33's northern spiral arm. Crank up the magnification, and look for two tiny lobes in contact. A nebula filter will improve your view of this nebula, but worsen the view of the rest of the galaxy. 100

Look for these celestial targets nearby:

RAY J. GABANY

››› **M74,** a magnitude 11.2 elliptical galaxy, lies 7.8° west.

››› **NGC 507,** a magnitude 11.3 elliptical galaxy, lies 3.4° northwest.

››› **NGC 752,** a magnitude 5.7 open cluster, lies 8.7° north-northeast.

››› **Collinder 21,** a magnitude 8.2 open cluster, lies 4.9° southeast.

IF YOU LIKE THIS OBJECT, be sure to observe:
M100 — page 23 • **M101** — page 39 • **Cetus A (M77)** — page 84

81 The Double Cluster

Open clusters in Perseus

Grab your binoculars and head out on any dark Northern Hemisphere autumn night. Your target, which lies between the "W" of Cassiopeia and Perseus' "head," is a binary object — the famed Double Cluster.

Greek philosopher Hipparchus (190–120 B.C.) first cataloged this object in 130 B.C. Danish astronomer Tycho Brahe (1546–1601) added it to his catalog as a star, and Johann Bayer assigned the Greek letter Chi (χ) to it. In the mid-19th century, astronomers began designating the two clusters separately, using the letter h, with which Bayer had labeled a nearby star.

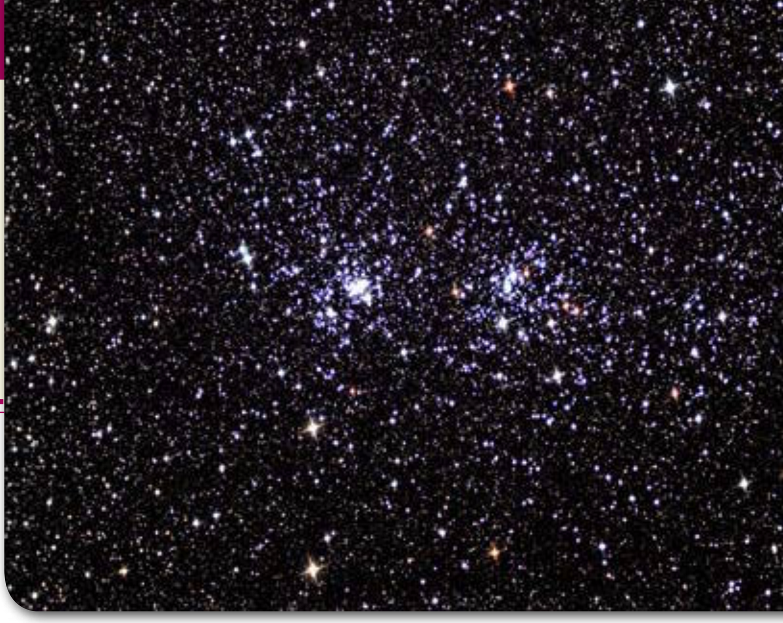
For observing the Double Cluster, binoculars with magnifications above 10x work best. This wonder demands extended views, so mount your binoculars on a tripod, and share M33 with family and friends.

NGC 869 is the richer of the two clusters, containing nearly three dozen 9th- and 10th-magnitude stars in an area 10' across. NGC 884 appears less concentrated but holds more bright stars, with the densest group on the southwestern edge. Through a 4-inch telescope at 50x, you'll see an abundance of color in these stellar jewels. Look for red, yellow, and blue gems scattered among the abundant white stars.

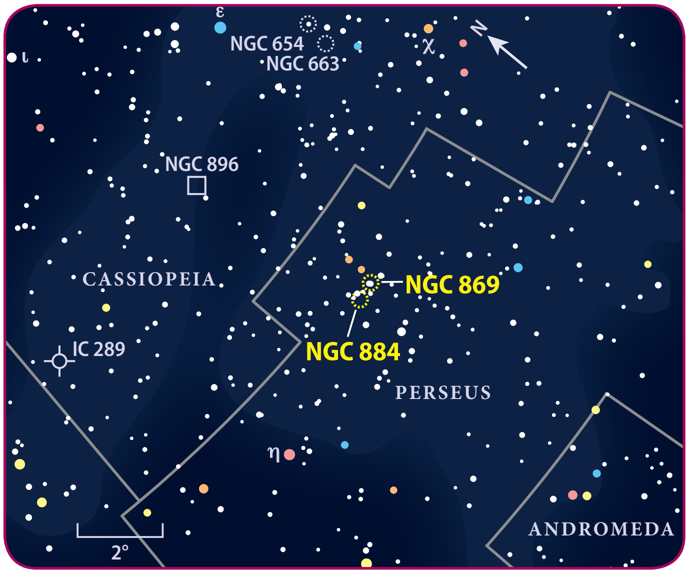
Each cluster holds a treasure at its core. NGC 869 contains a dark, Y-shaped rift. NGC 884's stars surround RS Persei, a deep-red semiregular variable star.

Double Cluster statistics

Also known as: h and χ Persei, NGC 869 and NGC 884, and Caldwell 14
Right ascension: 2h21m
Declination: 57°08'
Magnitudes: 4.3 and 4.4
Apparent size: 30' each
Distance: 7,200 and 7,500 light-years
Visible: North of latitude 32° S.



THE DOUBLE CLUSTER (NGC 884 [left] and NGC 869) are two open clusters in Perseus. Binoculars or low-power eyepieces split the clusters and resolve their stars. FRED CALVERT/ADAM BLOCK/NOAO/AURA/NSF



LYING AMONG THE STARS of the rich, northern Milky Way, open star clusters NGC 869 and NGC 884 stand out nonetheless.

Look for these celestial targets nearby:

››› **NGC 896,** an emission nebula, lies 4.9° north.

››› **IC 289,** a magnitude 13.2 planetary nebula, lies 7.8° northeast.

››› **Maffei 1,** a magnitude 11.4 elliptical galaxy, lies 3.3° northeast.

››› **Stock 2,** a magnitude 4.4 open cluster, lies 2.2° north-northwest.

JEFF HAPEMAN/ADAM BLOCK/NOAO/AURA/NSF

IF YOU LIKE THIS OBJECT, be sure to observe:
M41 — page 6 • **The Jewel Box Cluster (NGC 4755)** — page 32 • **The Pleiades (M45)** — page 87

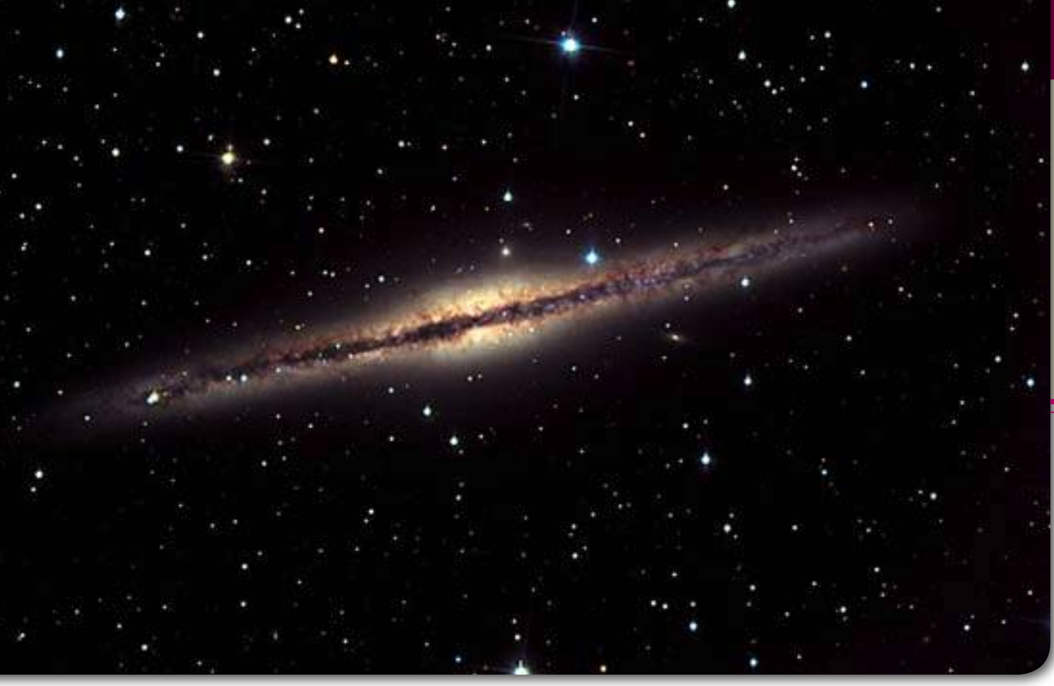
BEST SEEN: **OCTOBER 31**

82 NGC 891

Spiral galaxy in Andromeda

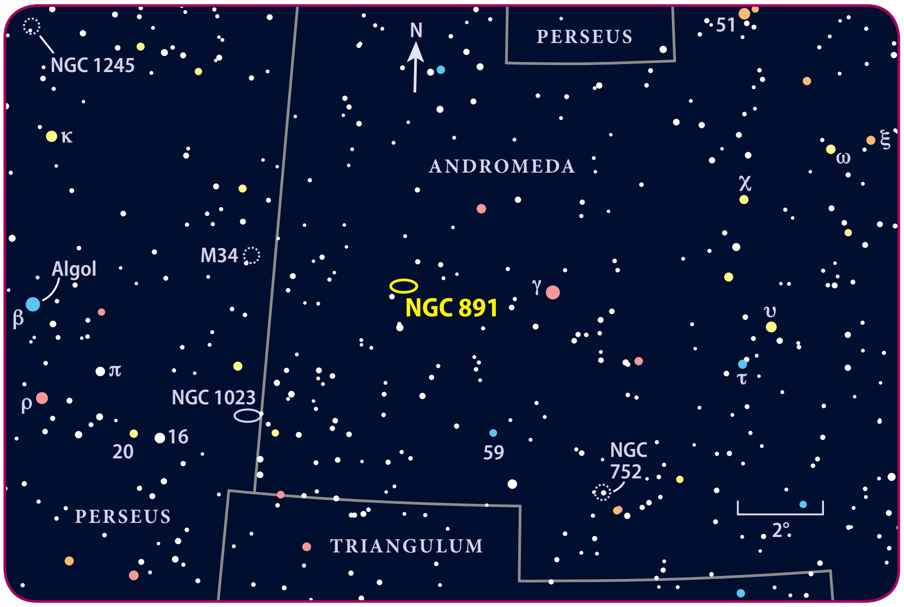
NGC 891 statistics

Also known as: Caldwell 23
Right ascension: 2h23m
Declination: 42°21'
Magnitude: 10.1
Apparent size: 13.5' by 3'
Distance: 10 million light-years
Visible: North of latitude 47° S.



SPIRAL GALAXY NGC 891 IN ANDROMEDA IS ALMOST EXACTLY EDGE-ON from our vantage point. Through an 8-inch or larger telescope, you'll see the thin dust lane that bisects NGC 891 lengthwise. Note that one side of NGC 891's nucleus outshines the other. ADAM BLOCK/NOAO/AURA/NSF

NGC 891 lies 3.4° east of the famous double star Gamma (γ) Andromedae.



Second place is fine if people remember you. NGC 891's problem, however, is that it's Andromeda's second-best galaxy. Not bad, except the top dog happens to be one of the sky's supreme wonders — the Andromeda Galaxy (page 75).

Sir William Herschel discovered NGC 891 October 6, 1784. Some sources attribute this galaxy's discovery to Herschel's sister Caroline, but that mistake resulted when Herschel confused this galaxy with another in the appendix to his first catalog.

NGC 891 is a spectacular telescopic target and one of the sky's best edge-on galaxies; it inclines only 1.4° to our line of sight.

A 10-inch telescope reveals a symmetrical object about 10' long with a noticeable but narrow central bulge. A dark dust lane bisects the galaxy and runs nearly its entire length. Dozens of foreground stars populate the field, adding a third dimension to the view.

At magnifications greater than 200x, note the sections of NGC 891's nucleus on each side of the dust lane. The western section glows slightly brighter. Likewise, the galaxy's disk to the southwest outshines its lesser half, which lies to the northeast. 100

Look for these celestial targets nearby:

- ››› **M34,** a magnitude 5.2 open cluster, lies 3.9° east.
- ››› **NGC 752,** a magnitude 5.7 open cluster, lies 6.6° southwest.
- ››› **NGC 1023,** a magnitude 9.5 elliptical galaxy, lies 4.7° southeast.
- ››› **NGC 1275,** a magnitude 11.7 spiral galaxy, lies 10.7° east.

ANTHONY AYIOMAMITIS

IF YOU LIKE THIS OBJECT, be sure to observe:
The Cigar Galaxy (M82) — page 16 • The Needle Galaxy (NGC 4565) — page 26 • The Whale Galaxy (NGC 4631) — page 29

83 The Heart Nebula

Emission nebula in Cassiopeia

Heart Nebula statistics

Also known as: IC 1805 and Melotte 15

Right ascension: 2h33m

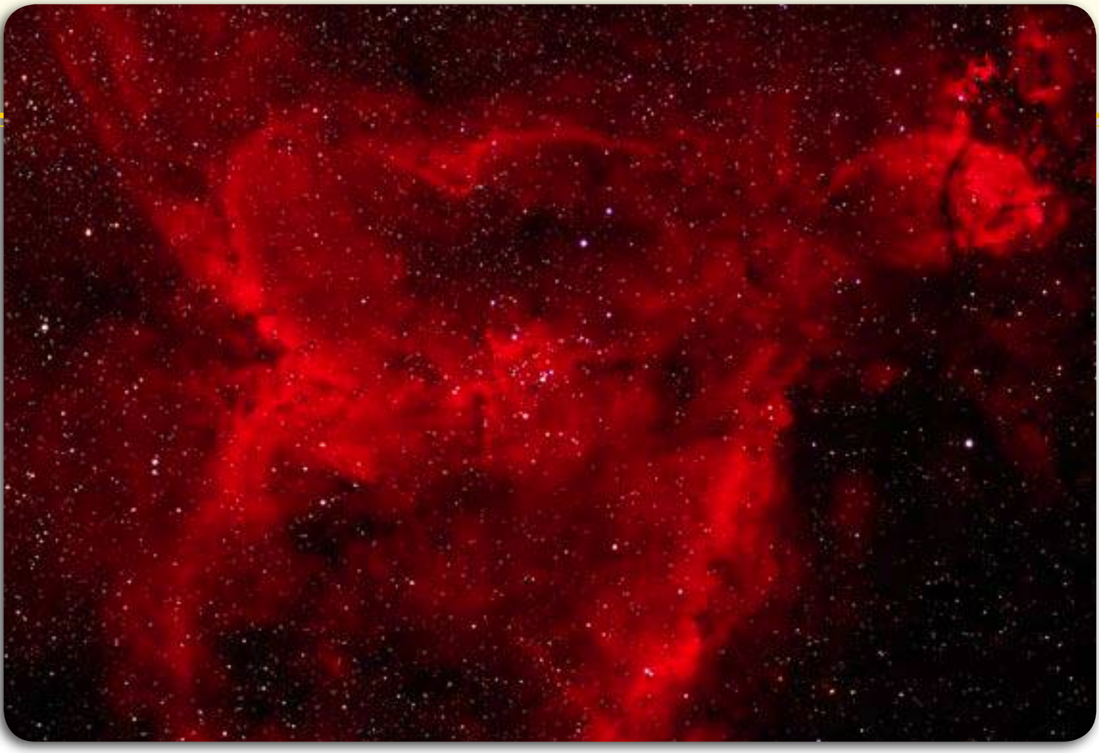
Declination: 61°27'

Magnitude: 6.5

Apparent size: 60'

Distance: 7,800 light-years

Visible: North of latitude 28° S.



THE HEART NEBULA (IC 1805) in Cassiopeia combines glowing gas clouds, dark dust clouds, and the star cluster Melotte 15 at its center. A nebula filter will help you see the gaseous regions. PIERRE TREMBLAY

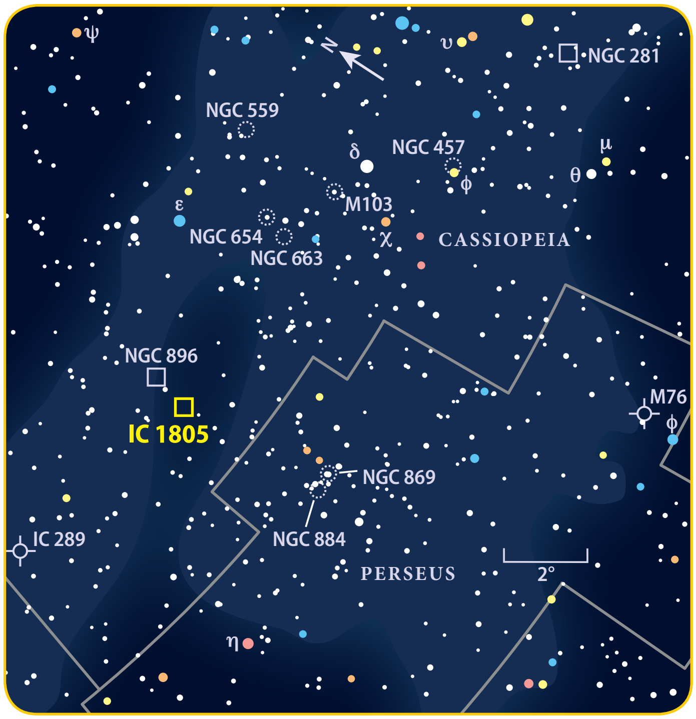
Some nebulae glow because a hot star within them emits enough energy to excite hydrogen atoms. The atoms cannot hold the extra energy long, however, and they reemit it as light with a characteristic red color.

The Heart Nebula, in contrast, glows because it contains an entire cluster of stars that formed within it. The combined radiation from cluster stars makes such nebulae bigger, brighter, or both.

Several of the stars in IC 1805's central cluster are true giants, 50 times more massive than the Sun. In addition to powering the Heart Nebula's glow, these stars' stellar winds propel hydrogen into space, where gaseous rings overlap other rings. This gives the "heart" its shape.

For an overall view, use an eyepiece that provides a 1° field of view. Insert a nebula filter, and identify the heart's brightest regions: the central cluster, the knot of nebulosity to the east, and the crescent of gas to the southwest.

The magnitude 6.7 star cluster NGC 1027 shines 1.2° east of the nebula. This cluster spans 15'. Another bright, condensed nebulous knot, NGC 896, lies 1° northwest of the Heart Nebula. Many observers see this 20'-wide object before they spot IC 1805. 100



NO REASONABLY BRIGHT STAR lies in the vicinity of IC 1805. To find it, star-hop 4.8° east-southeast from magnitude 3.4 Epsilon (ε) Cassiopeiae.

Look for these celestial targets nearby:

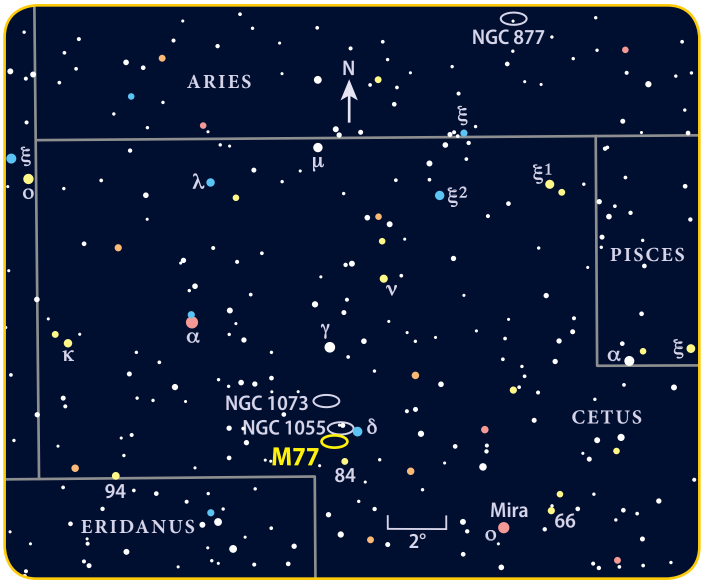
- ››› **NGC 609,** a magnitude 11.0 open cluster, lies 7.1° west-northwest.
- ››› **NGC 637,** a magnitude 8.2 open cluster, lies 8.2° west-northwest.
- ››› **NGC 1027,** a magnitude 6.7 open cluster, lies 1.2° east.
- ››› **Stock 23,** an open cluster, lies 5.5° east.

IF YOU LIKE THIS OBJECT, be sure to observe:

The Eta Carinae Nebula (NGC 3372) — page 19 • **The Trifid Nebula (M20)** — page 48 • **The Flame Nebula (NGC 2024)** — page 92

84 Cetus A

Spiral galaxy in Cetus



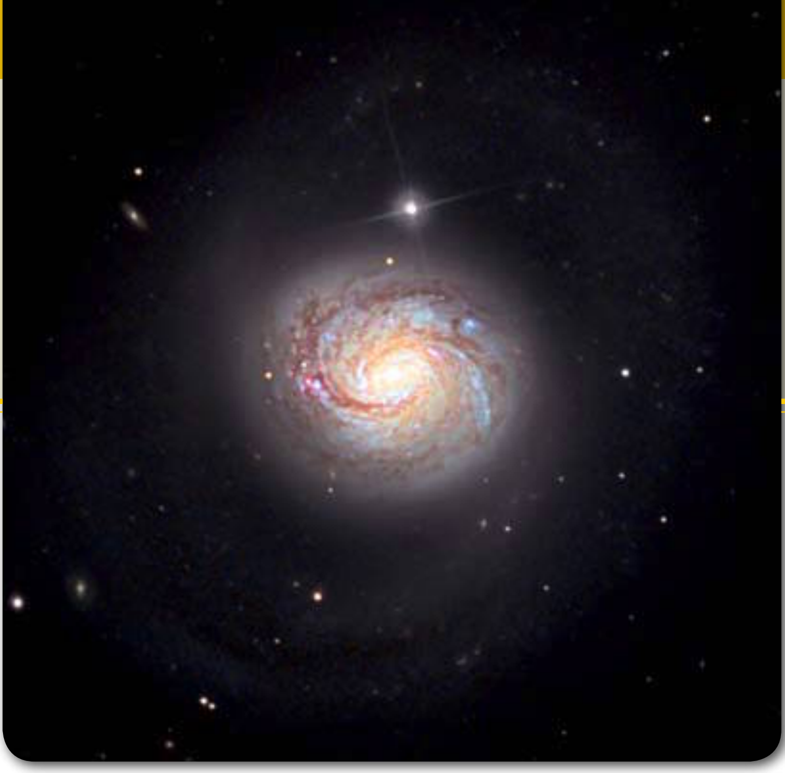
M77 forms the vertex of a right triangle with Delta (δ) and 84 Ceti. Each of these stars lies within a degree of M77.

Look for these celestial targets nearby:

NGC 1055

DANIEL VERSCHATSE

- **NGC 936,** a magnitude 10.2 spiral galaxy, lies 3.9° west-southwest.
- **NGC 1022,** a magnitude 11.3 spiral galaxy, lies 6.7° south.
- **NGC 1055,** a magnitude 10.6 spiral galaxy, lies 0.5° north-northwest.
- **NGC 1073,** a magnitude 10.8 spiral galaxy, lies 1.4° north.



CETUS A (M77) in Cetus exemplifies a face-on galaxy. Because of this galaxy's low surface brightness, you'll want to observe it from a site located away from city lights. FRANCOIS AND SHELLEY PELLETIER/ADAM BLOCK/NOAO/AURA/NSF

One of the sky's most active galaxies sits in the huge but seldom-recognized constellation Cetus the Whale. And it's doubly unfortunate for observers, because much of this galaxy's drama occurs outside the wavelengths of visible light.

Pierre Méchain discovered M77 October 29, 1780. Charles Messier included it in his updated catalog December 17 and wrote, "A cluster of small stars which contains some nebulosity in the Whale and on the parallel of the star delta, reported of the 3rd mag. but which M. Messier estimates to be of the 5th."

Astronomers classify M77 as a Seyfert galaxy. American astronomer Carl K. Seyfert (1911–1960) pioneered research on nuclear emissions in spiral galaxies. He described galaxies with bright nuclei that emit light from highly ionized gas. Furthermore, the gas is moving at high velocity. These features indicated the galaxies' cores were expelling giant gas clouds at high speeds.

Later, astronomers demonstrated Seyfert galaxies are a subclass of a much broader group: galaxies with active galactic nuclei. They discovered a supermassive central black hole was the power source for the activity seen in M77.

Visually, the galaxy's central area, one-third its total width, commands observers' attention. Although you can spot M77 through any telescope, a 10-inch or larger instrument and a magnification above 300x will reveal the most detail.

Try not to stare at M77's bright core, and search the disk surrounding it for signs of mottled structure. Through even larger telescopes, look for the tightly wound spiral arms — the brightest one lies southeast of the core.

Cetus A statistics

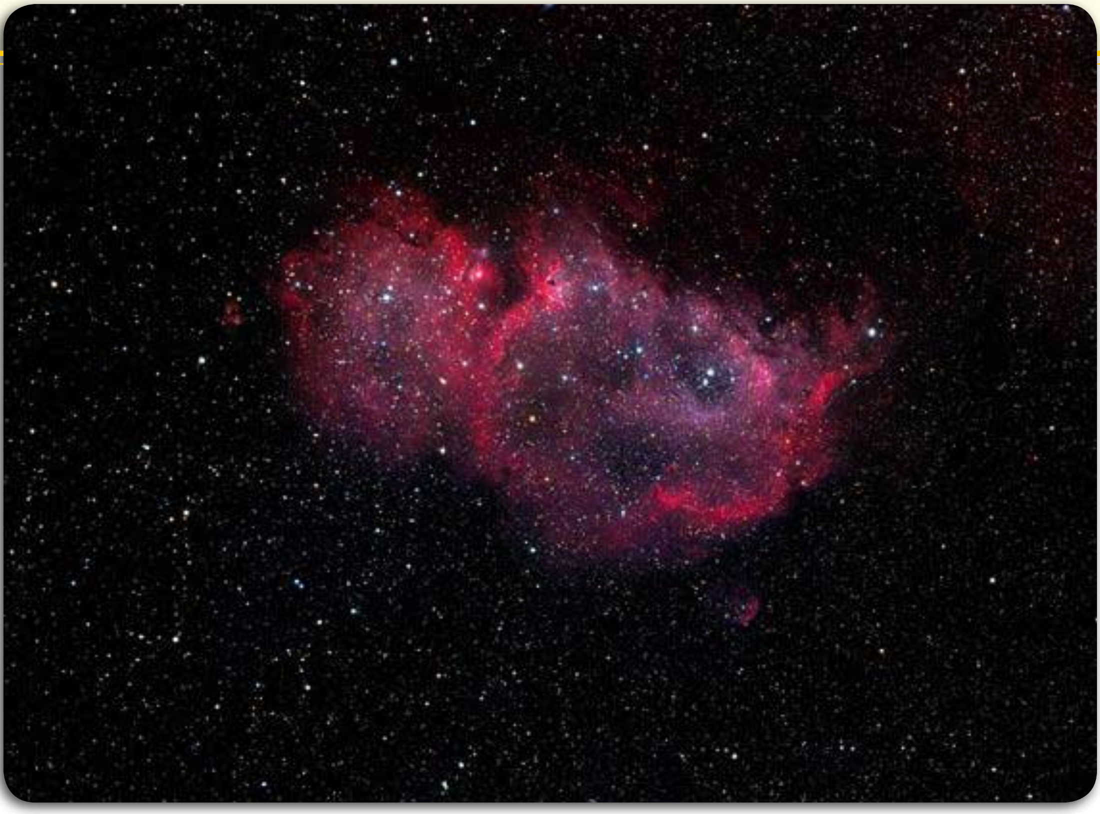
Also known as: M77 and NGC 1068
Right ascension: 2h43m
Declination: –0°01'
Magnitude: 8.9
Apparent size: 7' by 6'
Distance: 60 million light-years
Visible: Worldwide

IF YOU LIKE THIS OBJECT, be sure to observe:
NGC 2903 — page 14 • M94 — page 30 • The Southern Whirlpool Galaxy (M83) — page 38

BEST SEEN: **NOVEMBER 8**

85 The Baby Nebula

Emission nebula in Cassiopeia



THE BABY NEBULA (IC 1848) in Cassiopeia consists of a nebula and a star cluster. Observers often refer to IC 1848 as the Soul Nebula because it lies near the Heart Nebula (page 83). JIM BURNELL

Baby Nebula statistics

Also known as: Soul Nebula and IC 1848

Right ascension: 2h52m

Declination: 60°26'

Magnitude: 6.5

Apparent size: 60'

Distance: 7,000 light-years

Visible: North of latitude 29° S.

Surroundings mean a lot. Take IC 1848, for example. When viewed or imaged alone, most amateur astronomers call it the Baby Nebula because of its shape. Combine it with the Heart Nebula (IC 1805, page 83), however, and, collectively, the pair becomes the Heart and Soul nebulae.

The Baby Nebula sits 2.5° east-southeast of the Heart Nebula. Although equally as wide (1°) as IC 1805, the Baby Nebula doesn't cover as much area, so it appears more concentrated.

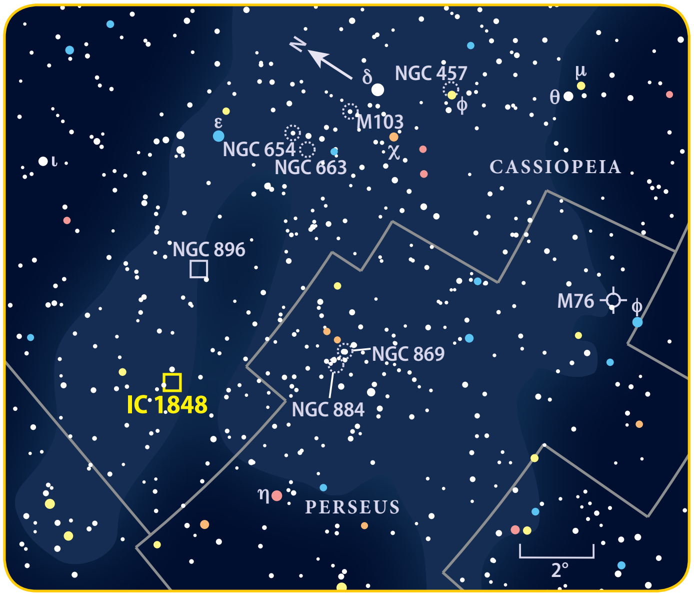
A nebula-filtered view shows two large regions that form the "baby's" head and body. The head appears denser, while the body surrounds a small star cluster within. To see the stars better, remove the nebula filter.

Through a 12-inch or larger telescope, you'll notice brightness differences along the body's edge. Look for two crescent-shaped nebulae, a smaller one to the northeast and a larger one to the west.

Finally, note the faint but populous stars that surround IC 1848. 100

Look for these celestial targets nearby:

- **NGC 1501,** a magnitude 11.5 planetary nebula, lies 9.2° east-northeast.
- **NGC 1502,** a magnitude 6.9 open cluster, lies 9.3° east-northeast.
- **NGC 1569,** a magnitude 11.2 irregular galaxy, lies 12.2° east-northeast.
- **NGC 1444,** a magnitude 6.6 open cluster, lies 11.1° southeast.



IC 1848 LIES CLOSER to magnitude 3.8 Eta (η) Persei than to any bright star in Cassiopeia. Look 4.6° north of that star to find IC 1848.

IF YOU LIKE THIS OBJECT, be sure to observe:

The Cat's Paw Nebula (NGC 6334) — page 44 • The Eagle Nebula (M16) — page 49 • The Flame Nebula (NGC 2024) — page 92

BEST SEEN: **NOVEMBER 18**

86 NGC 1365

Barred spiral galaxy in Fornax

Barred spiral galaxies form a class of celestial objects that fascinate astronomers. Unfortunately for Northern Hemisphere observers, the best example — NGC 1365 — languishes in the nearly invisible constellation Fornax the Furnace. Fornax is more than one-third the way from the celestial equator to the South Celestial Pole.

A barred spiral galaxy contains a central lane of stars, gas, and dust. It has a small central bulge of stellar material. The spiral arms begin at both ends of the bar. Thanks to observations by the Spitzer Space Telescope, we now know our Milky Way is a barred spiral galaxy.

Astronomers using the Hubble Space Telescope revealed NGC 1365 feeds material into its central region, igniting massive star birth and causing its central bulge of stars to grow. The material also fuels a supermassive black hole in the galaxy's core.

Through a 4-inch scope at a dark site, you'll see NGC 1365's bar shape and bright central region. Increase the magnification, and notice how the bar appears dimmer near the core than it does farther out.

An 8-inch scope shows the arms. The brighter one extends northward from the bar's west end. The other arm, only slightly fainter, appears somewhat blotchy, revealing huge star-forming regions within it.

NGC 1365 statistics

Also known as: MGC 06–08–026

Right ascension: 3h34m

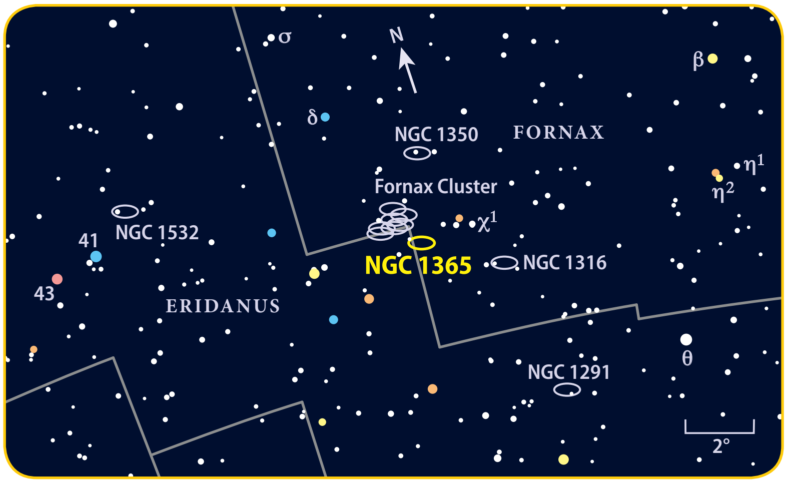
Declination: –36°08'

Magnitude: 10.3

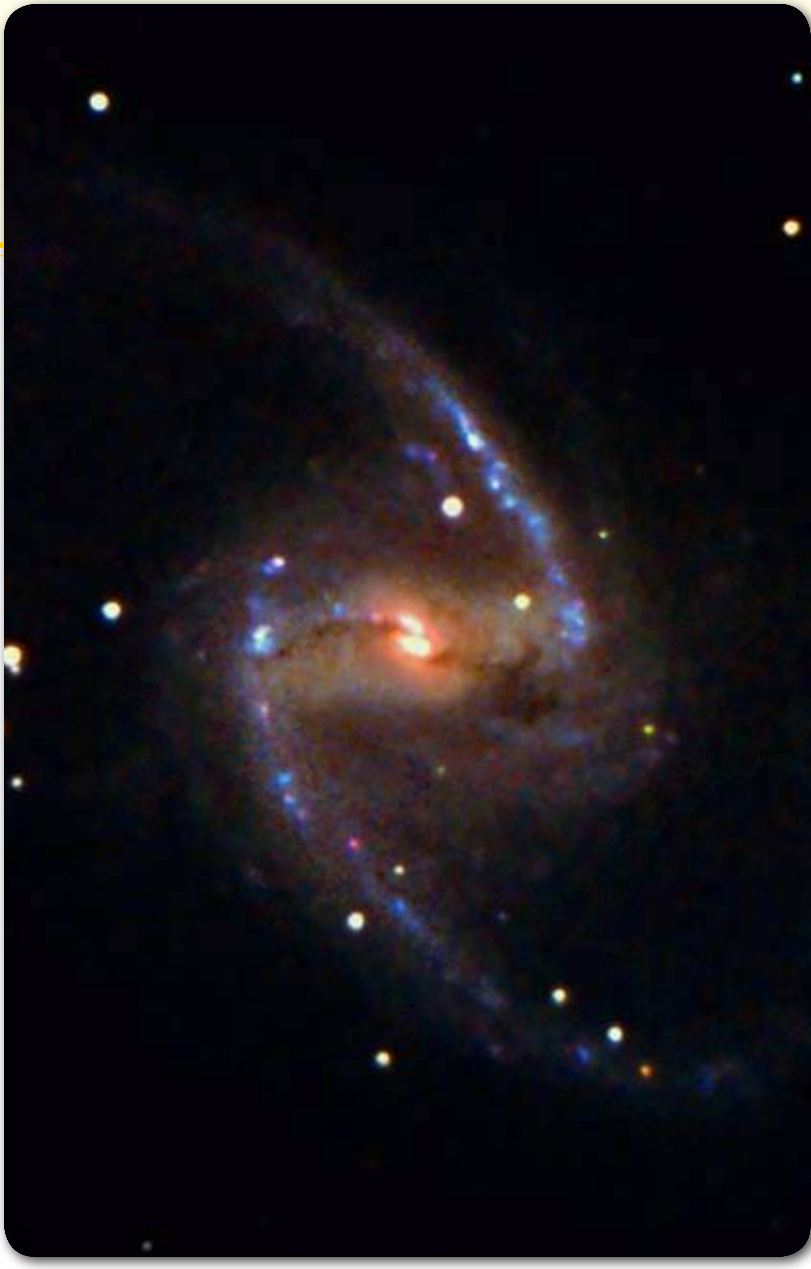
Apparent size: 11' by 6'

Distance: 60 million light-years

Visible: South of latitude 54° N.



LOOK FOR NGC 1365 1.5° east of Chi¹ (χ¹) Fornacis. Then scan northeast to encounter the brightest galaxies of the Fornax Cluster.



OBSERVERS RATE NGC 1365 in Fornax as the southern sky's finest barred spiral galaxy. JAMES R. FOSTER

Look for these celestial targets nearby:

- ››› **NGC 1291,** a magnitude 8.5 spiral galaxy, lies 5.9° south-southwest.
- ››› **NGC 1527,** a magnitude 10.7 spiral galaxy, lies 13.4° south-southeast.
- ››› **NGC 1532,** a magnitude 9.8 spiral galaxy, lies 8.6° east-northeast.
- ››› **NGC 1567,** a magnitude 11.5 elliptical galaxy, lies 14.9° south-southeast.

IF YOU LIKE THIS OBJECT, be sure to observe:

M106 — page 22 • The Southern Whirlpool Galaxy (M83) — page 38 • The Southern Pinwheel Galaxy (NGC 300) — page 78

BEST SEEN: **NOVEMBER 21**

87 The Pleiades

Open cluster in Taurus

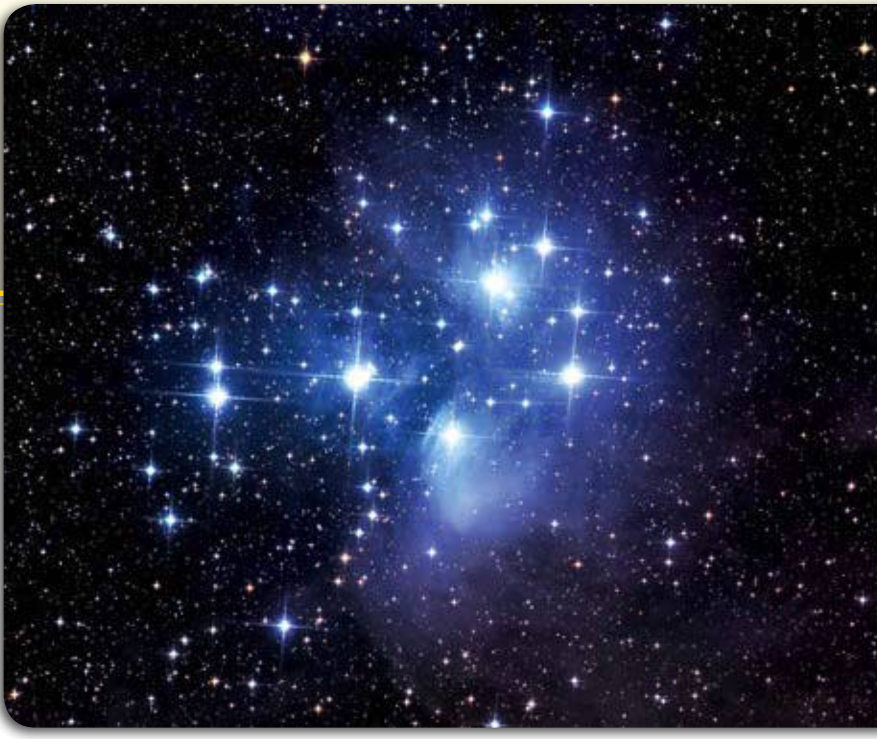
Many ancient astronomers, including Greek mathematician and astronomer Eudoxus of Cnidos (408–355 B.C.), classified the Pleiades as a separate constellation. And why not? This object shines brighter and is more recognizable than many of the 88 constellations that currently fill the sky. Greek philosopher Ptolemy (*ca.* 90–168), however, assigned this group to Taurus, and it's been part of that constellation ever since.

Charles Messier included the Pleiades as the 45th and final entry in the first version of his *Catalog of Nebulae and Clusters of Stars*, which he presented to the Paris Academy of Sciences February 16, 1771. Why he included such a bright, well-known object remains a mystery. Even in Messier's day, most people — and certainly all observers — knew the Pleiades was no comet.

Most amateur astronomers choose binoculars in the 10x to 15x range to observe the Pleiades. Because it's so bright and easy to see, this cluster sparks lots of comments and questions during autumn and winter public observing sessions.

For more of a challenge, search the Pleiades for the elusive Merope Nebula (NGC 1435). German astronomer Ernst Wilhelm Leberecht Tempel (1821–1889) discovered this reflection nebula in 1859.

A 3-inch telescope will show NGC 1435's brightest area, 0.2° south of the star Merope (23 Tau). Unfortunately, this object does not respond to nebula filters, so try all your eyepieces, and stick with the one that gives the best view. At high magnification, move Merope just out of the field of view. NGC 1435 reflects the light of M45's stars but is not part of the cluster. It's simply a cloud of dust and gas passing through the Pleiades.



THE PLEIADES (M45) is the closest and brightest star cluster. Some observers test their eyesight by counting individual stars in the cluster. How many can you see with your unaided eyes? GEORGE GREANEY

Look for these celestial targets nearby:

››› **NGC 972,** a magnitude 11.3 spiral galaxy, lies 17° west-northwest.

››› **NGC 1156,** a magnitude 11.7 irregular galaxy, lies 10.8° west.

››› **Hind's Variable Nebula (NGC 1554),** a reflection nebula, lies 9.3° east-southeast.

››› **NGC 1647,** a magnitude 6.4 open cluster, lies 14.5° east-southeast.

Pleiades statistics

Also known as: the Seven Sisters and M45

Right ascension: 3h47m

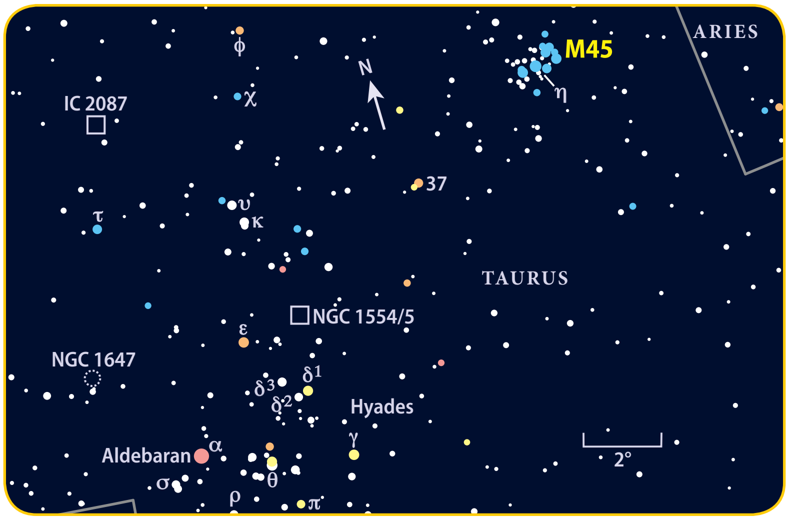
Declination: 24°07'

Magnitude: 1.5

Apparent size: 110'

Distance: 450 light-years

Visible: North of latitude 66° S.



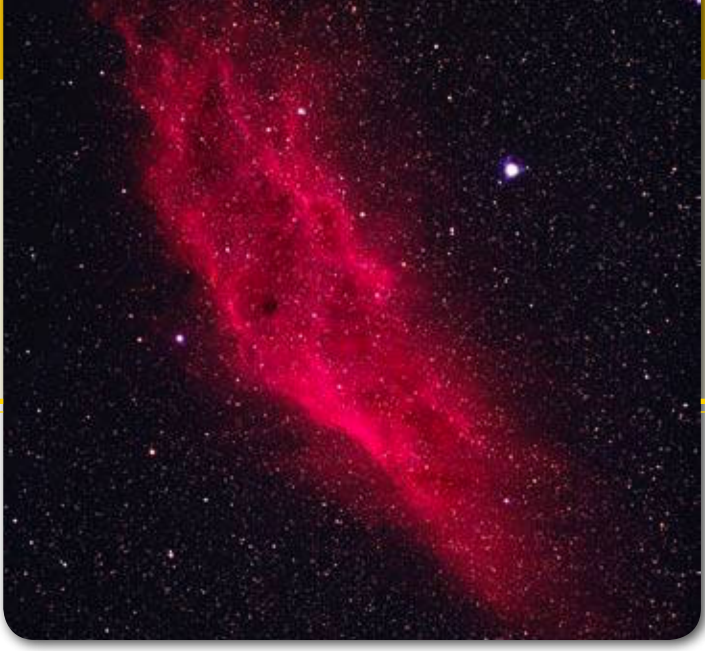
M45 IS EASY to see, but can you spot the Merope Nebula (NGC 1435)? This wispy cloud surrounds Merope (23 Tauri) and is visible at low magnification even through a 4-inch telescope.

IF YOU LIKE THIS OBJECT, be sure to observe:
The Tau CMa Cluster (NGC 2362) — page 8 • **The Jewel Box Cluster (NGC 4755)** — page 32 • **The Northern Jewel Box (NGC 6231)** — page 43

BEST SEEN: **NOVEMBER 24**

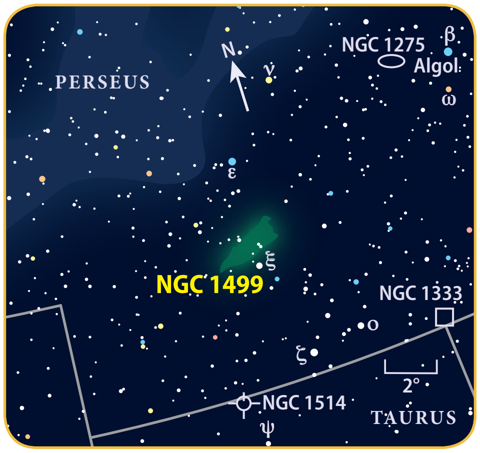
88 The California Nebula

Emission nebula in Perseus



THE CALIFORNIA NEBULA (NGC 1499) in Perseus looks much better in long-exposure astrophotographs than it does to the eye because of its low surface brightness. Use a Hydrogen-beta filter, and pan your scope around for the best view. GEORGE GREANEY

LOOK ABOVE Perseus' "foot," and head 0.8° north-northeast of Menkib (Xi [ξ] Persei) to find NGC 1499.



November's last celestial wonder is a rarity: a nebula you can spot without a telescope or binoculars. It's also the only celestial object named for one of America's 50 states.

This unusually shaped nebula resides in one of the Milky Way's spiral arms called the Orion arm. The region contains vast hydrogen clouds from which many bright, massive stars have formed. Astronomers labeled this family of young stars the Perseus OB2 association.

The bright star 0.2° south of the nebula is magnitude 4.0 Menkib (Xi [ξ] Persei). It belongs to the Perseus OB2 association, and its radiation makes the California Nebula glow. This nebula is unusual because it glows strongly not only due to Hydrogen-alpha (Hα) emission, but also Hydrogen-beta (Hβ).

Hydrogen atoms emit light because of the elevation and subsequent drop in energy level of electrons. The electrons gain energy from Xi Persei. A larger "fall" (number of levels an electron drops) releases light with more energy.

In this case, a one-level drop creates Hα light with a wavelength of 656.3 nanometers. An electron dropping two levels creates Hβ light with a wavelength of 486.1 nanometers. In most nebulae, electrons fall just one level, emitting Hα light.

From a dark site, sharp-eyed observers can spot the California Nebula with their naked eyes — almost. Use a nebula filter labeled either "Hβ" or "Deep sky." An OIII filter reduces what you can see.

When you switch to a telescope, select the eyepiece that provides the lowest magnification. Don't forget to attach a filter. If even that view isn't wide enough to take in the whole object, slowly move the telescope back and forth.

Look for these celestial targets nearby:

››› **NGC 1060,** a magnitude 12.0 elliptical galaxy, lies 16.9° west.

››› **Perseus A (NGC 1275),** a magnitude 11.7 spiral galaxy, lies 9.9° west-northwest.

››› **NGC 1333,** an emission nebula, lies 8.6° west-southwest.

››› **NGC 1514,** a magnitude 10.9 planetary nebula, lies 5.7° south-southeast.

RAY J. GaBANY

California Nebula statistics

Also known as: NGC 1499
Right ascension: 4h01m
Declination: 36°37'
Magnitude: —
Apparent size: 145' by 40'
Distance: 1,100 light-years
Visible: North of latitude 53° S.

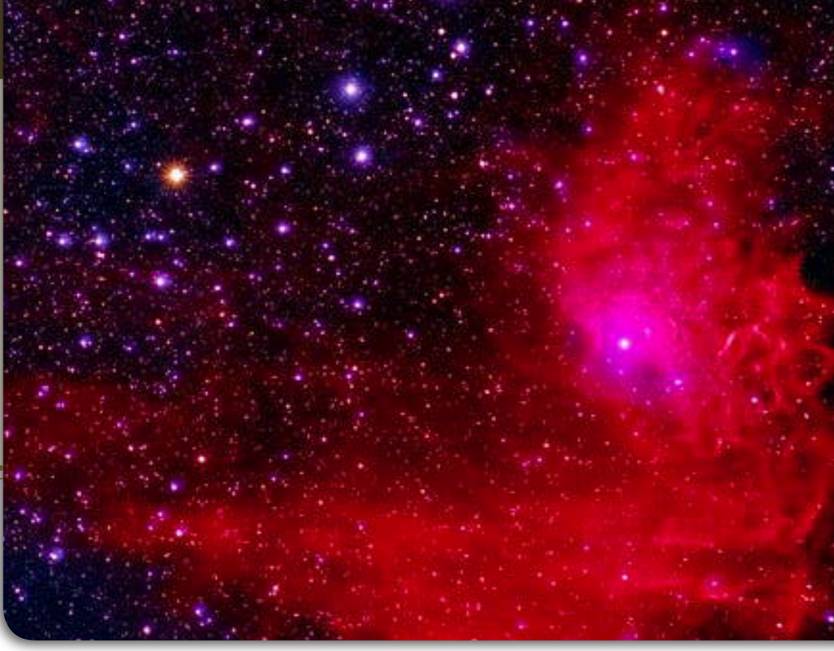
IF YOU LIKE THIS OBJECT, be sure to observe:

The Eta Carinae Nebula (NGC 3372) — page 19 • The Rho Ophiuchi region — page 40 • The Flame Nebula (NGC 2024) — page 92

Best seen: **DECEMBER 12**

89 The Flaming Star Nebula

Emission nebula in Auriga



THE FLAMING STAR NEBULA (IC 405) glows because of intense radiation from the star AE Aurigae. Nearly 3 million years ago, gravitational interactions between stars ejected AE Aurigae from the Orion Nebula (M42). DANIEL B. PHILLIPS

Flaming Star Nebula statistics

Also known as: IC 405 and Caldwell 31

Right ascension: 5h17m

Declination: 34°23′

Magnitude: —

Apparent size: 30'

Distance: 1,500 light-years

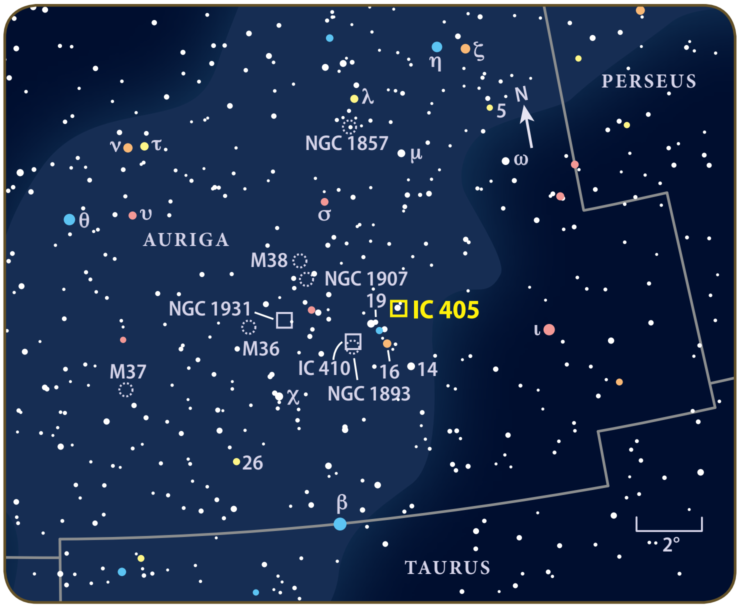
Visible: North of latitude 55° S.

Most nebulae glow because a bright star or star cluster formed within their midsts. Ultraviolet radiation from stars excites hydrogen atoms, causing them to glow. In the Flaming Star Nebula, the star AE Aurigae is the power source. But AE did not form there.

More than 2 million years ago, AE was a hot, young star within the Orion Nebula (page 92). Gravitational interactions with nearby stars sent the star on a wild ride into space. By chance, we now see it passing through IC 405. As it does, it illuminates parts of the nebula. Also, pressure from AE Aurigae's starlight and particles from its stellar wind push the tenuous gas out of its way.

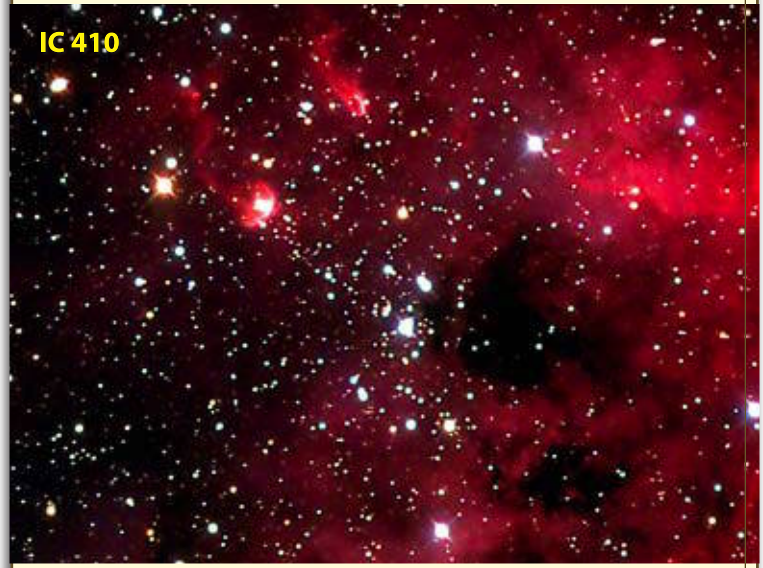
German-born American astronomer John Martin Schaeberle (1853–1924) discovered the Flaming Star Nebula February 6, 1892. He found it on a photograph he took through a 6-inch refractor at Lick Observatory on Mt. Hamilton in California. German astronomer Max Wolf (1863–1932) coined this object's common name in 1903.

Through a 6-inch telescope, the Flaming Star Nebula appears triangular, with one point at the star AE Aur. Increase the scope's aperture and add a Hydrogen-beta filter both to improve the nebula's contrast and dim AE Aur and other field stars.



TARGET THE FLAMING STAR NEBULA 0.8° west-northwest of a group of 5th- and 6th-magnitude stars, the brightest of which is 18 Aurigae.

Look for these celestial targets nearby:



CHRIS SCHUR

- ››› **NGC 1778,** a magnitude 7.7 open cluster, lies 3.2° northwest.
- ››› **NGC 1857,** a magnitude 7.0 open cluster, lies 5° north.
- ››› **IC 410,** an emission nebula, lies 1.6° southeast.
- ››› **Palomar 2,** a magnitude 13.0 globular cluster, lies 7° west-southwest.

IF YOU LIKE THIS OBJECT, be sure to observe:

The Trifid Nebula (M20) — page 48 • The Omega Nebula (M17) — page 49 • The Gamma Cygni region — page 59

Best seen: **DECEMBER 14**

90 The Large Magellanic Cloud

Irregular galaxy in Dorado

THE LARGE MAGELLANIC CLOUD is one of the Milky Way's satellite galaxies. It lies 170,000 light-years away in the southern constellation Dorado the Swordfish. DANIEL VERSCHATSE

Large Magellanic Cloud statistics

Also known as: the LMC and Nubecula Major
Right ascension: 5h24m
Declination: –69°45'
Magnitude: 0.1
Apparent size: 650' by 550'
Distance: 179,000 light-years
Visible: South of latitude 20° N.

Southern Hemisphere observers definitely enjoy the sky's better half. Below the celestial equator lie the brightest stars, the center of our galaxy, the best dark nebulae, and the most brilliant celestial wonder — the Large Magellanic Cloud.

Read the details of the LMC's discovery in "The Small Magellanic Cloud" (page 77). The LMC and SMC show signs of past interaction. Also, a 10°-wide, 100°-long band of neutral gas called the Magellanic Stream runs through the LMC, the SMC, and the Milky Way's disk.

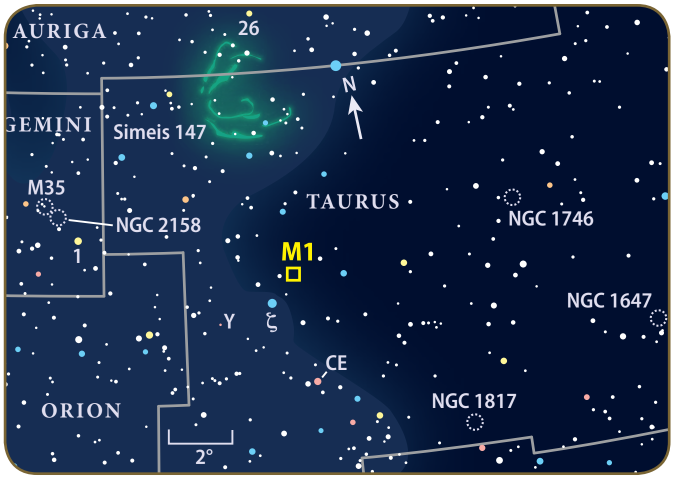
No less than 114 NGC objects lie within the LMC's boundaries. The finest, the Tarantula Nebula (page 94) is itself one of the 100 most spectacular celestial wonders.

Under a dark sky, start observing the LMC without optical aid. Note

Best seen: **DECEMBER 16**

91 The Crab Nebula

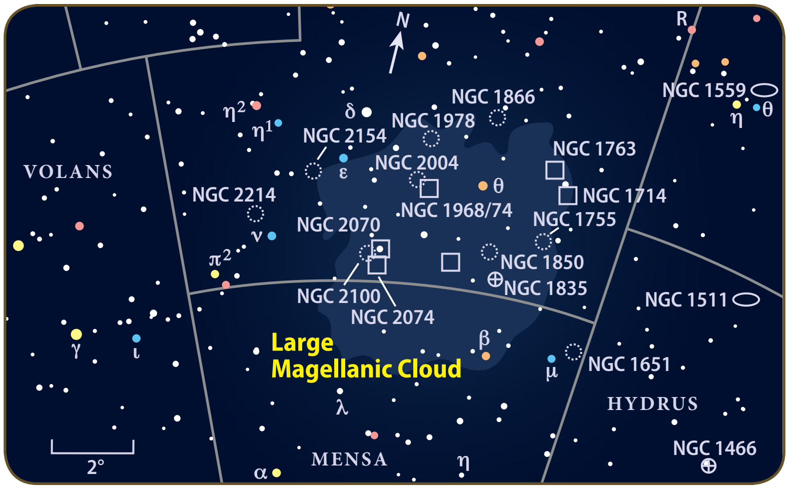
Supernova remnant in Taurus



FIND THE CRAB NEBULA by starting at the 4th-magnitude bluish star Zeta (ζ) Tauri and moving 1° to the northwest. The Crab appears as a diffuse glow through binoculars.

THE CRAB NEBULA (M1) is an expanding supernova remnant. In A.D. 1054, the supernova appeared as a brilliant new "star" in Taurus. BRIAN LULA

IF YOU LIKE THIS OBJECT, be sure to observe:
Centaurus A (NGC 5128) — page 34 • Barnard's Galaxy (NGC 6822) — page 56 • The Small Magellanic Cloud — page 77



DORADO IS ONE OF THE SKY'S best regions to observe, thanks to the LMC. Use low power for the galaxy and high power for the many objects within it.

the galaxy's brightest region, a luminous bar measuring roughly 5° by 1°. Outside the bar, the brightness drops rapidly, but you'll still detect an oval haze measuring 6° by 4°. To extend the LMC's boundary beyond this, use binoculars or a rich-field telescope and pan back and forth.

Through a 6-inch or larger telescope and a magnification around 200x, slowly scan back and forth across the LMC's face. Pause to examine the many star clusters and nebulae. A nebula filter will help you see the nebulae better but will worsen your view of clusters.

Look for these celestial targets nearby:

NGC 1313

DANIEL VERSCHATSE

- »› **NGC 1313,** a magnitude 9.1 spiral galaxy, lies 12° west.
- »› **NGC 1559,** a magnitude 10.4 spiral galaxy, lies 9.6° northwest.
- »› **NGC 1835,** a magnitude 6.5 open cluster, lies 1.3° southwest.
- »› **NGC 2004,** a magnitude 9.6 open cluster, lies 2.6° north-northeast.

Crab Nebula statistics

Also known as: M1 and NGC 1952
Right ascension: 5h35m
Declination: 22°01'
Magnitude: 8.0
Apparent size: 6' by 4'
Distance: 6,300 light-years
Visible: North of latitude 67° S.

In 1054, a brilliant new star 4 times brighter than Venus appeared near Taurus the Bull's southern horn. For more than 3 weeks, it remained visible during daylight hours.

The supernova that formed the nebula exploded with such force that the gas expanded outward at 4 million mph (6.5 million km/h). M1 now measures 10 light-years across.

English astronomer John Bevis (1695–1771) discovered the Crab Nebula in 1731. Messier independently discovered it August 28, 1758, while searching for Halley's Comet during its first predicted return. Messier soon realized the object was no comet, and he made it the first object in his celebrated list. M1 received its common name after Lord Rosse sketched it in 1844, and other astronomers noted its crab-like resemblance.

M1 has high surface brightness, so even a 3-inch telescope will reveal it. On the other hand, this object shows few details through instruments with apertures less than 16 inches. The Crab Nebula appears oval and oriented northwest to southeast.

Look for these celestial targets nearby:

NGC 1662

ERICA AND DAN SIMPSON/ADAM BLOCK/NOAO/AURA/NSF

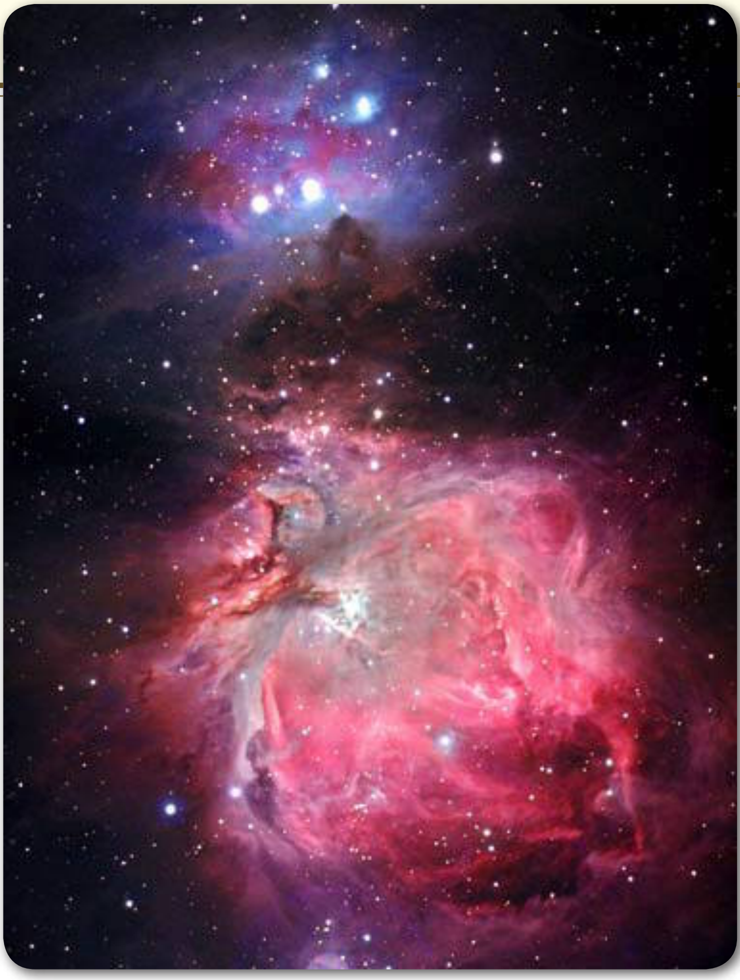
- »› **NGC 1662,** a magnitude 6.4 open cluster, lies 15.6° southwest.
- »› **NGC 1807,** a magnitude 7.0 open cluster, lies 7.8° southwest.
- »› **NGC 1817,** a magnitude 7.7 open cluster, lies 7.5° southwest.
- »› **NGC 2175,** a magnitude 6.6 open cluster, lies 8.3° east.

IF YOU LIKE THIS OBJECT, be sure to observe:
The Pencil Nebula (NGC 2736) — page 13 • The Veil Nebula (NGC 6990/92/95) — page 61 • The Helix Nebula (NGC 7293) — page 68

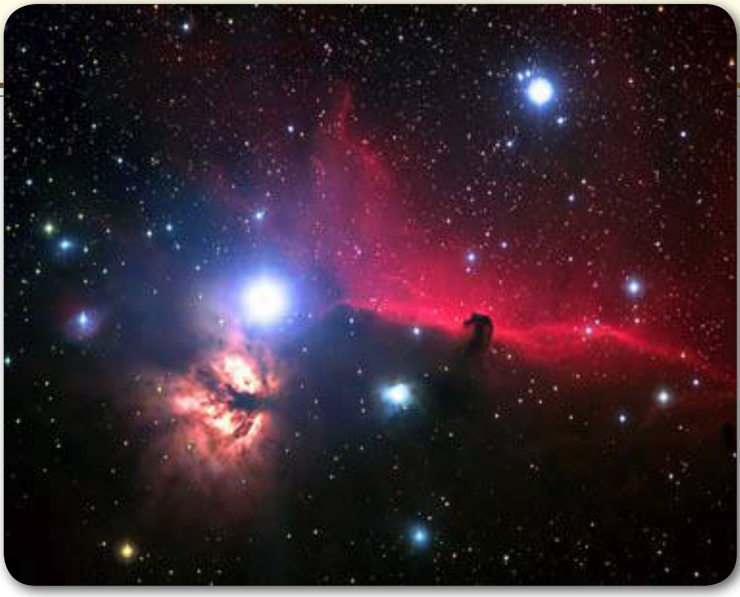
Best seen: **DECEMBER 16**

92–95 Orion

Four wonders in The Hunter



THE ORION NEBULA (M42) in Orion's "sword" is the sky's brightest nebula. Explore it with all your eyepieces. JASON WARE



THE FLAME NEBULA (NGC 2024) lies 15' from Alnitak (Zeta [ζ] Orionis). Intense radiation from Alnitak sparks the Flame's glow. ADAM BLOCK/NOAO/AURA/NSF

Orion Nebula statistics

Also known as: M42 and NGC 1976
Right ascension: 5h35m
Declination: –5°23'
Magnitude: 3.7
Apparent size: 85' by 60'
Distance: 1,600 light-years
Visible: South of latitude 84° N.

This book lists the 100 best celestial wonders by visibility during the year. If we had ranked them by popularity, however, the **Orion Nebula** easily would claim the top spot.

Prior to the telescope, celestial cartographers cataloged this region as a star. Johannes Bayer, in his *Uranometria*, assigned it the Greek letter Theta (θ). French patron Nicolas-Claude Fabri de Peiresc (1580–1637) first spotted the nebula in 1610.

M42 is the sky's brightest diffuse nebula. Easily seen from a dark site, sharp-eyed observers can detect this cloudy patch even under moderate light pollution. Large telescopes show the full extent of this object, which covers an area 6 times the size of the Full Moon. Although you don't need a nebula filter to see lots of detail, using one at a dark location accentuates the contrast between the light and dark regions.

Only 0.1° north-northeast of the Orion Nebula's center lies M43. It is often called De Mairan's Nebula in honor of its discoverer, French mathematician Jean-Jacques d'Ortous de Mairan (1678–1771). Note M43's sharp eastern edge, which is caused by a dark nebula overlapping that area.

Not quite 4° north-northeast of M42 lies the **Flame Nebula**. If you dial in this distance, however, you'll find yourself staring at magnitude 2.0 Zeta (ζ) Orionis, the southernmost star in Orion's Belt. The Flame Nebula sits only 15' southeast of this luminary, so increase the magnification past 100x, and move Zeta out of the field of view. A nebula filter helps, but even it won't dim dazzling Zeta enough.

If you can see the Flame Nebula easily, try for the wonder many observers consider the ultimate challenge object — the **Horsehead Nebula** (B33). This dark protrusion sits in front of emission nebula IC 434. Only 15' to its northeast lies NGC 2023, a 10'-wide dot of bright nebulosity.

Flame Nebula statistics

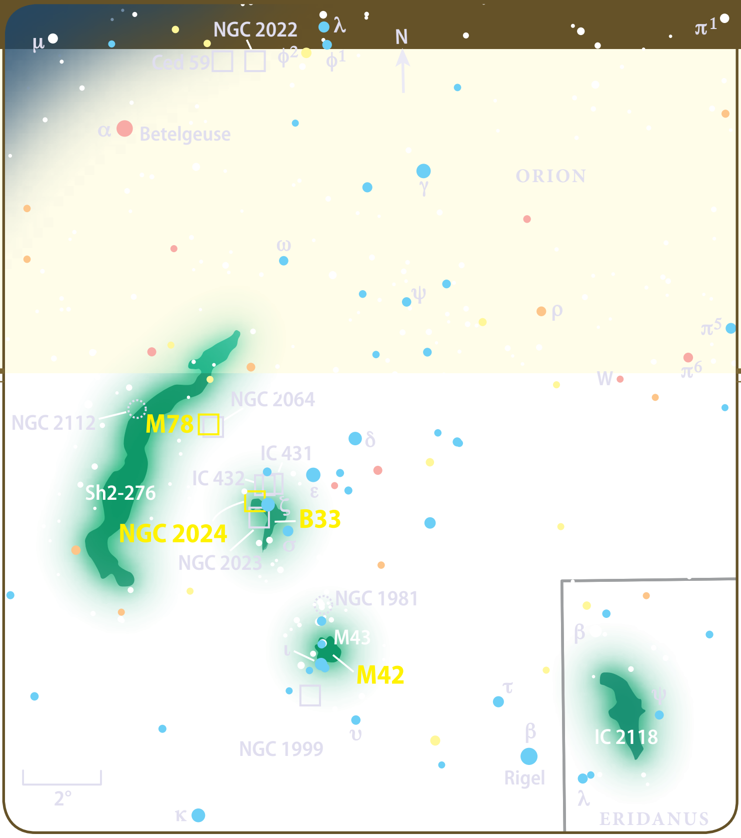
Also known as: NGC 2024
Right ascension: 5h42m
Declination: –1°54'
Magnitude: —
Apparent size: 30'
Distance: 1,500 light-years
Visible: South of latitude 88° N.

IF YOU LIKE THIS OBJECT, be sure to observe:
The Jewel Box (NGC 4755) — page 32 • The Northern Jewel Box (NGC 6231) — page 43 • The Pleiades (M45) — page 87

Look for these celestial targets nearby:

STEPHAN SEIP AND ELKE SCHULZ/ADAM BLOCK/NOAO/AURA/NSF

- ››› **M79,** a magnitude 7.7 globular cluster, lies 19.3° south.
- ››› **NGC 1600,** a magnitude 11.0 elliptical galaxy, lies 15.8° west.
- ››› **NGC 1637,** a magnitude 10.8 spiral galaxy, lies 13.7° west.
- ››› **NGC 1700,** a magnitude 11.2 elliptical galaxy, lies 9.6° west.
- ››› **NGC 2022,** a magnitude 11.6 planetary nebula, lies 14.6° north.
- ››› **NGC 2112,** a magnitude 9.1 open cluster, lies 7.4° northeast.
- ››› **NGC 2170,** an emission nebula, lies 8.1° east.
- ››› **NGC 2215,** a magnitude 8.4 open cluster, lies 11.5° east.
- ››› **NGC 2232,** a magnitude 4.2 open cluster, lies 13.1° east.
- ››› **The Witch Head Nebula** (IC 2118), a reflection nebula, lies 7.9° west-southwest.



ORION DOMINATES the winter sky. Deep-sky treats in this constellation range from bright objects like the Orion Nebula (M42), to faint ones such as the Horsehead Nebula (B33).

EIGHTH-MAGNITUDE M78 in Orion is the sky's brightest reflection nebula. DANIEL GOOD

M78 statistics

Also known as: NGC 2068
Right ascension: 5h47m
Declination: 0°01'
Magnitude: 8.0
Apparent size: 8' by 6'
Distance: 1,600 light-years
Visible: worldwide

Horsehead Nebula statistics

Also known as: Barnard 33
Right ascension: 5h41m
Declination: –2°28'
Magnitude: —
Apparent size: 6' by 4'
Distance: 1,600 light-years
Visible: South of latitude 87° N.

Although observers have seen the dark protrusion through telescopes as small as 5 inches in aperture, a 12-inch or larger scope will bring out the horsehead shape. A nebula filter will help, but to make this wonder really pop, use a Hydrogen-beta filter.

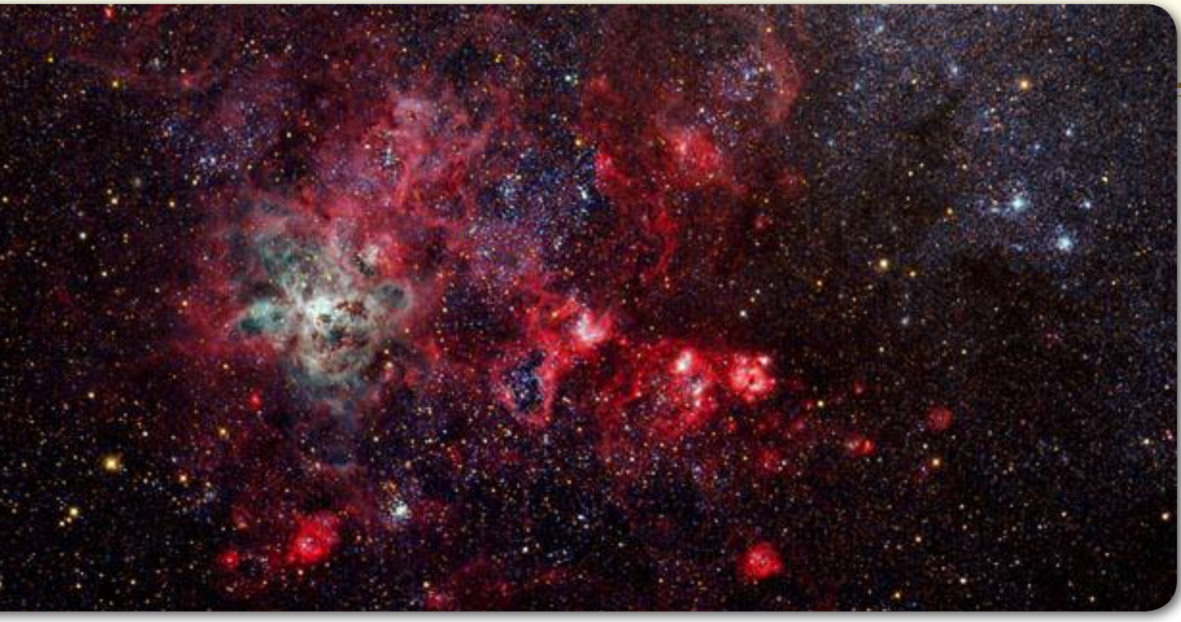
Not quite 3° north-northeast of the Horsehead Nebula lies the sky's brightest reflection nebula — **M78**. No filter improves the view of reflected starlight, but a magnification around 150x will show two nebulous nuclei bracketing an 11th-magnitude star. The small emission nebula NGC 2067 sits only 0.1° northwest of M78. A dark lane divides the two objects. A nebula filter will help you see NGC 2067 a bit better, but there's a lot more detail in M78.

THE HORSEHEAD NEBULA (B33), one of the sky's most famous dark nebulae, sits 38' south-southwest of the Flame Nebula. R. JAY GABANY

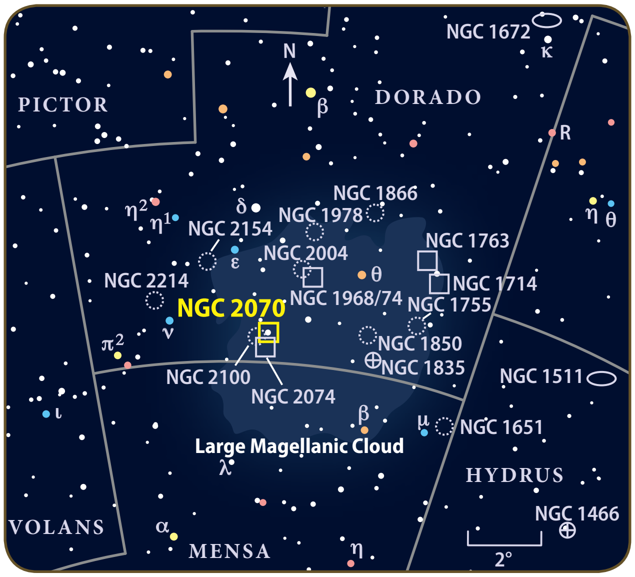
Best seen: **DECEMBER 17**

96 The Tarantula Nebula

Emission nebula in Dorado



THE TARANTULA NEBULA (NGC 2070) in Dorado belongs to the Large Magellanic Cloud. It is the only extragalactic nebula visible to the naked eye. The bright cluster at bottom left-center is NGC 2100. GERALD RHEMANN AND MICHAEL JÄGER



THE TARANTULA NEBULA stands on the eastern edge of the Large Magellanic Cloud amidst a swarm of open star clusters.

Tarantula Nebula statistics

Also known as: 30 Doradus, the Looped Nebula, the True Lover's Knot, NGC 2070, and Caldwell 103

Right ascension: 5h39m

Declination: –69°06'

Magnitude: 8.0

Apparent size: 40' by 25'

Distance: 170,000 light-years

Visible: South of latitude 30° N.

Look for these celestial targets nearby:

DANIEL VERSCHATSE

- ››› **NGC 1866,** a magnitude 9.7 open cluster, lies 4.3° northwest.
- ››› **NGC 2100,** a magnitude 9.6 open cluster, lies 0.3° east-southeast.
- ››› **NGC 2214,** a magnitude 10.9 open cluster, lies 3.2° east.
- ››› **NGC 2442,** a magnitude 10.4 spiral galaxy, lies 10.3° east-southeast.

Most northern observers, unfortunately, haven't experienced the Tarantula Nebula. Although it lies in the Large Magellanic Cloud, this object looks incredible through medium-sized telescopes. With a true diameter of 1,000 light-years, NGC 2070 would span 20° if it were as close as the Orion Nebula, in the Milky Way.

English astronomer John Flamsteed (1646–1719) cataloged NGC 2070 as the star 30 Doradus. French astronomer Nicolas Louis de Lacaille (1713–1762) recognized it as a nebula December 5, 1751.

The brightest star cluster in the Tarantula Nebula, and the most remarkable star-forming region in the local universe, is R136. Many of its 60 stars are among the most massive, brightest, and hottest known.

Even through a 4-inch telescope, NGC 2070 shows loops and filaments. A dense central bar runs along a north-south line. R136 is easy to spot as a 1'-wide region of several dozen bright stars. The longest filament begins near the cluster's center and extends 7' to the south. It then extends eastward and loops an equal distance to the north.

The appearance of nebulous "ropes" encircling darker regions led English astronomer William Henry Smyth to describe this nebula as the True Lover's Knot. According to some accounts, 16th-century Dutch sailors tied similar knots to remind them of lovers they'd left behind. 100

IF YOU LIKE THIS OBJECT, be sure to observe:
The Rho Ophiuchi region — page 41 • The Eagle Nebula (M16) — page 49 • The Cocoon Nebula (IC 5146) — page 67

97 The Salt and Pepper Cluster

Open cluster in Auriga

Salt and Pepper Cluster statistics

Also known as: M37 and NGC 2099

Right ascension: 5h52m

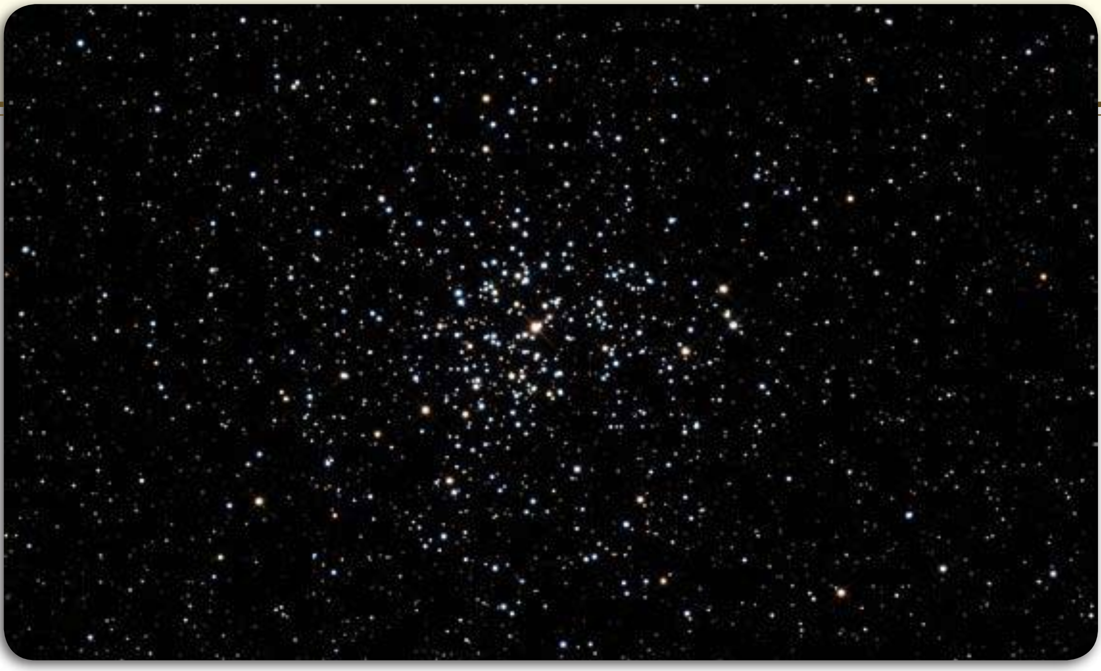
Declination: 32°33'

Magnitude: 5.6

Apparent size: 24'

Distance: 4,500 light-years

Visible: North of latitude 57° S.



THE SALT AND PEPPER CLUSTER (M37) in Auriga is visible to unaided eyes from a dark site but looks spectacular through large telescopes. Don't use a filter, which will cut down star brightness. ANTHONY AYIOMAMITIS

Want to make a model of a celestial object at home? Lay a piece of black paper on a table, and sprinkle a quarter teaspoon of salt on it. Then shine a bright light on the crystals. *Voilà*! M37. Well, not exactly, but you get the idea.

Giovanni Batista Hodierna discovered this star cluster prior to 1654. Charles Messier found it September 2, 1764. He wrote, "A cluster of small stars a little removed from the preceding [M36], the stars are smaller, more close together and enclosing some of the nebulosity."

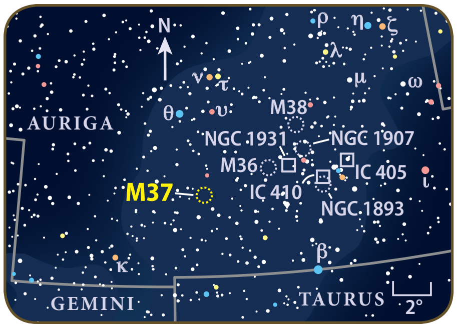
Admiral Smyth probably described it best when he wrote, "A magnificent object; the whole field being strewd, as it were, with sparkling gold dust and the group is resolvable into about 500 stars from 10–14 mag. besides outliers."

Through any size telescope, the Salt and Pepper Cluster displays an even distribution of stars not found in many other clusters. Although it sits squarely within the Milky Way, M37's edge is easy to discern.

A 3-inch telescope reveals 50 stars. The brightest member — a magnitude 9 orange star — sits near the cluster's center.

With many open clusters, increasing the size of the telescope worsens the view; as the cluster gets magnified, the stars thin. Also, larger scopes reveal more background stars, making it harder to see the cluster's outline.

Not with M37. With this wonder, larger scopes reveal more stars. Through a 10-inch scope, you'll count 200 stars, and a 16-inch will reveal 500.



M37, the easternmost of Auriga's fine open clusters, sits 4.9° south-southwest of magnitude 2.6 Theta (θ) Aurigae.

ANTHONY AYIOMAMITIS

Look for these celestial targets nearby:

››› **M36,** a magnitude 6.0 open cluster, lies 3.7° west-northwest.

››› **M38,** a magnitude 6.4 open cluster, lies 5.9° northwest.

››› **NGC 1907,** a magnitude 8.2 open cluster, lies 5.7° west-northwest.

››› **NGC 1931,** a magnitude 10.1 open cluster, lies 4.7° west-northwest.

IF YOU LIKE THIS OBJECT, be sure to observe:

M41 — page 6 • The Northern Jewel Box (NGC 6231) — page 43 • The Wild Duck Cluster (M11) — page 51

Best seen: **DECEMBER 24**

98 M35

Open cluster in Gemini

It's hard to resist a two-for-one sale, and that's exactly what this wonder offers. From a dark site, you'll spot M35 easily without optical aid. Point binoculars or a telescope at this cluster, however, and not only will it explode into stars, you'll see a second open cluster, NGC 2158.

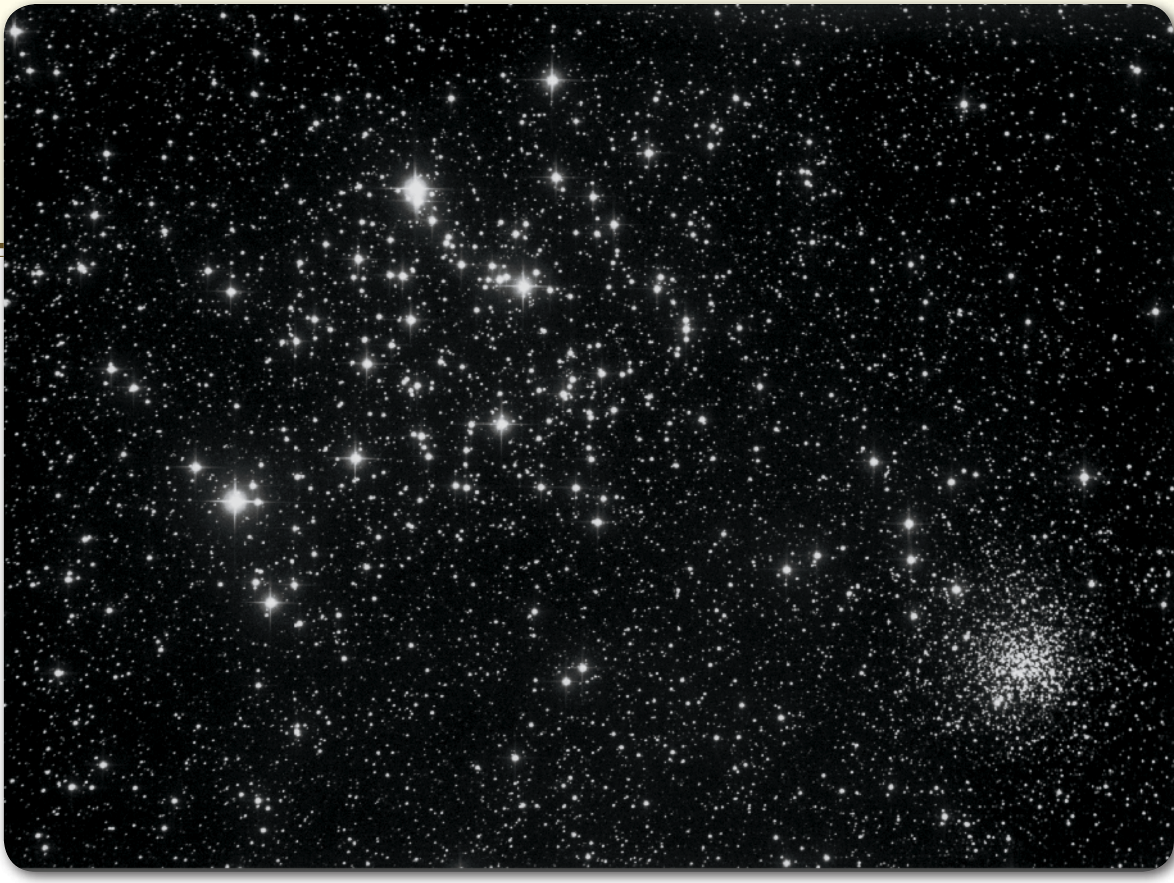
Philippe Loys de Chéseaux discovered this cluster in late 1745 or early 1746. English astronomer John Bevis (1695–1771) found it before 1750, the year he featured it in his star atlas, *Uranographia Britannica*. Charles Messier, who added it to his catalog August 30, 1764, credited Bevis for the discovery.

M35 contains two dozen stars brighter than 9th magnitude, most of which reside near the cluster's center. These stars align in many patterns; some of the arcs extend nearly 1°. Fainter members push the total number of visible stars past 200.

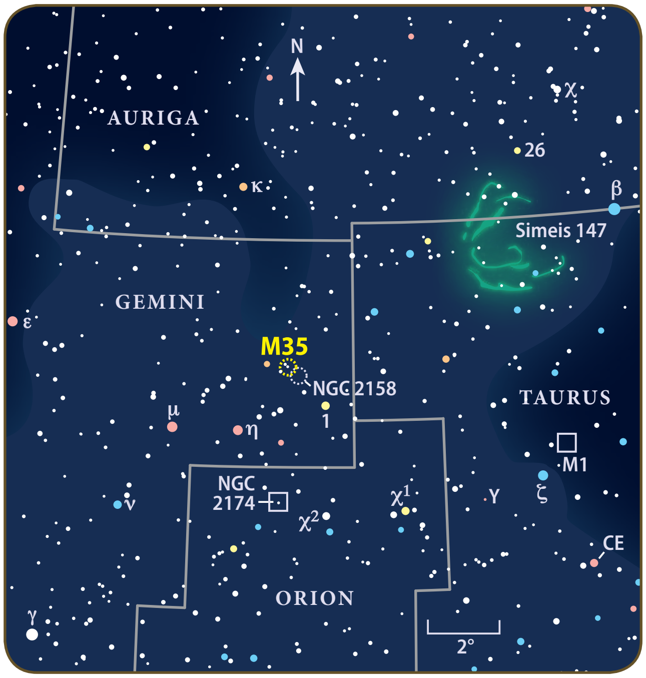
If you use a low-power eyepiece to engulf M35, NGC 2158 will look like a small, fuzzy ball. This cluster rewards high magnification. Through a 14-inch telescope at 500x, you'll count 30 stars. Increase the aperture to 20 inches, however, and you'll double that number.

M35 statistics

Also known as: NGC 2168
Right ascension: 6h09m
Declination: 24°21'
Magnitude: 5.1
Apparent size: 6'
Distance: 2,800 light-years
Visible: North of latitude 66° S.



OPEN CLUSTER M35 and its smaller companion, NGC 2158, reside in Gemini the Twins. You'll see M35 easily with binoculars, but NGC 2158 requires more aperture. MARTIN GERMANO



YOU'LL FIND M35, along with its companion cluster, NGC 2158, 1.5° northeast of 4th-magnitude 1 Geminorum.

Look for these celestial targets nearby:

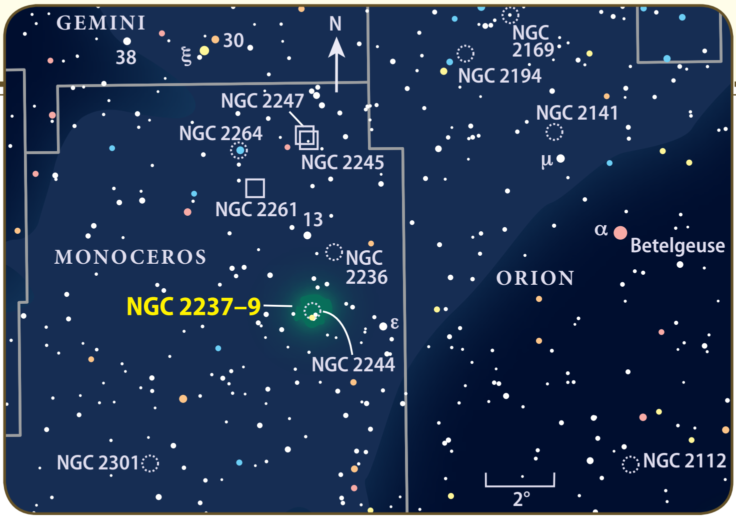
- **NGC 2129,** a magnitude 6.7 open cluster, lies 2.1° west-southwest.
- **NGC 2175,** a magnitude 6.6 open cluster, lies 3.8° south.
- **NGC 2266,** a magnitude 9.5 open cluster, lies 8.2° east-northeast.
- **NGC 2331,** a magnitude 8.5 open cluster, lies 13.3° east-northeast.

IF YOU LIKE THIS OBJECT, be sure to observe:
The Beehive Cluster (M44) — page 12 • Ptolemy's Cluster (M7) — page 46 • The Owl Cluster (NGC 457) — page 79

Best seen: **DECEMBER 27**

99 The Rosette Nebula

Emission nebula in Monoceros



NGC 2237–9 MAKES A NICE TRIANGLE with the stars 13 and Epsilon (ε) Monocerotis. It lies about 2° from each star.

Rosette Nebula statistics

Also known as: Swift's Nebula, NGC 2237–9, 46, and Caldwell 49
Right ascension: 6h32m
Declination: 4°58'
Magnitude: 7.0
Apparent size: 80' by 60'
Distance: 4,500 light-years
Visible: North of latitude 84° S.

The old saying, "It never rains, but it pours," applies to our last two wonders, both of which reside in the dim constellation Monoceros. With only three stars brighter than 4th magnitude, this star group ranks among the most difficult to identify. The objects it contains, however, tell a different story.

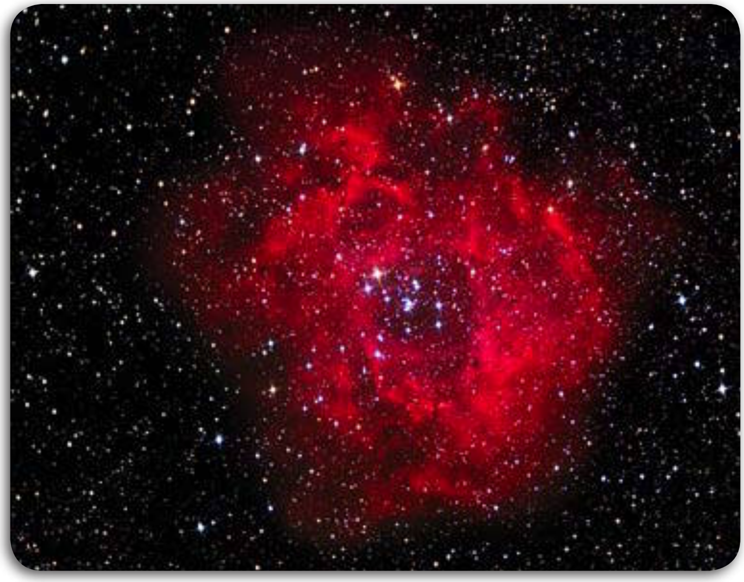
Most observers recognize the magnificent Rosette Nebula as a single deep-sky wonder. But this object wasn't found all at once.

Sir William Herschel discovered the open cluster NGC 2244 in 1784. This naked-eye star cluster lies at the heart of the Rosette Nebula. In 1864, German astronomer Albert Marth (1828–1897) discovered NGC 2238. To complete the picture, American astronomer Lewis Swift (1820–1913) discovered NGC 2237 in 1883 and NGC 2246 in 1886.

From a dark site, you'll first spot NGC 2244. A 4-inch telescope will reveal two dozen stars in an oval region elongated northwest to southeast; a half dozen of these surpass 8th magnitude.

To best observe the Rosette Nebula, use a magnification of 50x and insert a nebula filter to dim NGC 2244's stars. The nebula's western side appears brighter. Here, the ring's inner wall appears straight with a tiny bit of scalloping; the outer wall looks thin with an extension to the northwest.

The Rosette's eastern side is much wider. A nebulous wall with a well-defined border forms its northern edge. Although the Rosette is an emission nebula, your eye will also notice the many small dark nebulae superimposed on the bright background. 100



THE ROSETTE NEBULA (NGC 2237–9) in Monoceros has four NGC numbers assigned to it by astronomers, and this doesn't count the star cluster — NGC 2244 — at its center. ADAM BLOCK/NOAO/AURA/NSF

Look for these celestial targets nearby:

MARK AND PATRICIA WESSELS/ADAM BLOCK/NOAO/AURA/NSF

- ››› **NGC 2186,** a magnitude 8.7 open cluster, lies 4.7° west.
- ››› **NGC 2236,** a magnitude 8.5 open cluster, lies 1.8° north.
- ››› **Collinder 96,** a magnitude 7.3 open cluster, lies 2.2° south.
- ››› **Van den Bergh 1,** a magnitude 9.5 open cluster, lies 2.6° southeast.

IF YOU LIKE THIS OBJECT, be sure to observe:
NGC 6559 — page 49 • The Cocoon Nebula (IC 5146) — page 67 • The Baby Nebula (IC 1848) — page 85

Best seen: **DECEMBER 31**

100 The Cone Nebula

Emission nebula and open cluster

Cone Nebula statistics

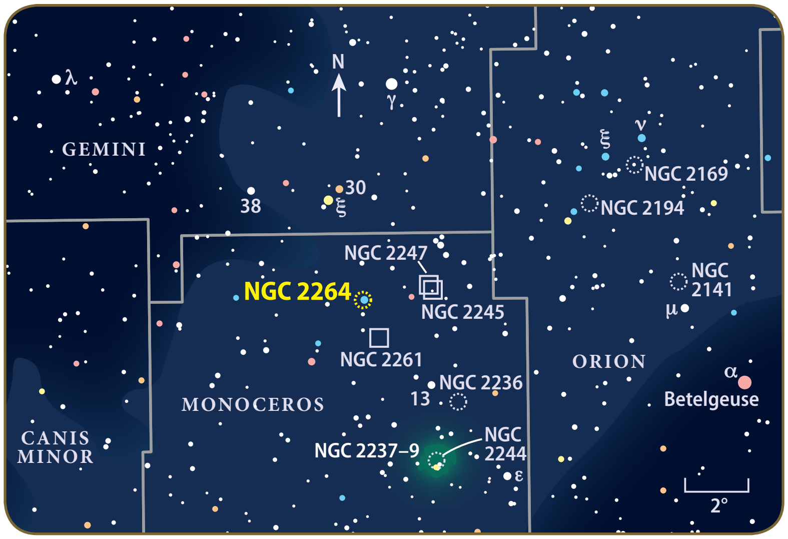
Also known as: 15 Monocerotis Cluster and NGC 2264
Right ascension: 6h41m
Declination: 9°53'
Magnitude: 3.9
Apparent size: 20'
Distance: 2,400 light-years
Visible: North of latitude 80° S.

Not only does this wonder combine an open star cluster and a nebula, each has its own common name. American astronomer and writer Leland S. Copeland dubbed the bright star group the Christmas Tree Cluster; the dark nebula is the Cone Nebula.

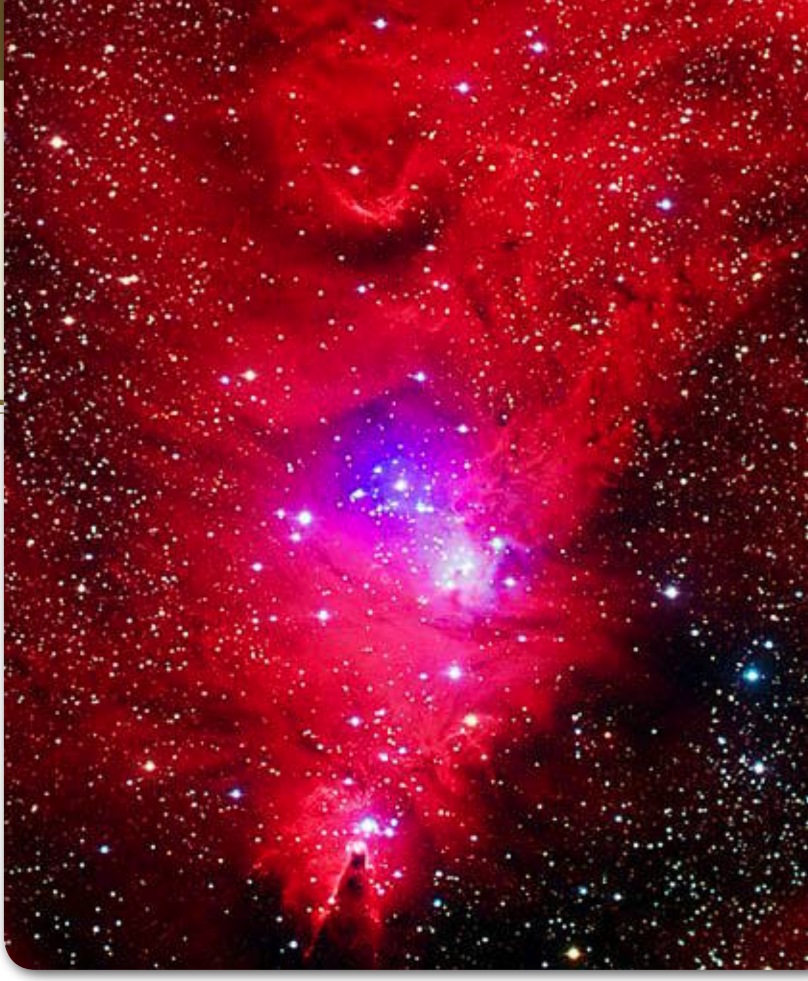
Sir William Herschel discovered the star cluster January 18, 1784. Then, nearly 2 years later, he found the Cone Nebula December 26, 1785. Modern astronomers discovered the nebula belongs to a large star-forming region sometimes called the Foxfur Nebula (Sh 2–273).

Through a 3-inch scope, the Christmas Tree Cluster looks triangular. The brightest star in view is 15 Monocerotis, which shines at magnitude 4.7. Extend a line of five or six stars east and west from 15 Mon to form the tree's 0.5°-long base. The rest of the tree extends to the south. A group of 8th- and 9th-magnitude stars forms the tree's top.

Point a 10-inch or larger scope at the southern stellar trio, and you're likely to see the Cone Nebula, a 5'-long strip of dark nebulosity. Use a nebula filter to dim the surrounding stars and increase the contrast.



NGC 2264 ENCOMPASSES A REGION MORE THAN 0.5° WIDE around the magnitude 4.7 star 15 Monocerotis. For the best views of the Cone Nebula, use an eyepiece that yields about 100x, and place this star outside the field of view.



THE CONE NEBULA (NGC 2264) lies within an active and colorful region of Monoceros. The Cone is a dark nebula, which is silhouetted against a brighter background. You'll need a large telescope to spot it. DANIEL B. PHILLIPS

Look for these celestial targets nearby:

Hubble's Variable Nebula

CHRIS SCHUR

- ››› **NGC 2259,** a magnitude 10.8 open cluster, lies 1.2° northwest.
- ››› **Collinder 106,** a magnitude 4.6 open cluster, lies 4.1° south-southwest.
- ››› **Collinder 111,** a magnitude 7.0 open cluster, lies 3° south.
- ››› **Hubble's Variable Nebula** (NGC 2261), a reflection nebula, lies 1.2° south-southwest.

IF YOU LIKE THIS OBJECT, be sure to observe:
The North America Nebula (NGC 7000) — page 62 • The Iris Nebula (NGC 7023) — page 63 • IC 1396 — page 66

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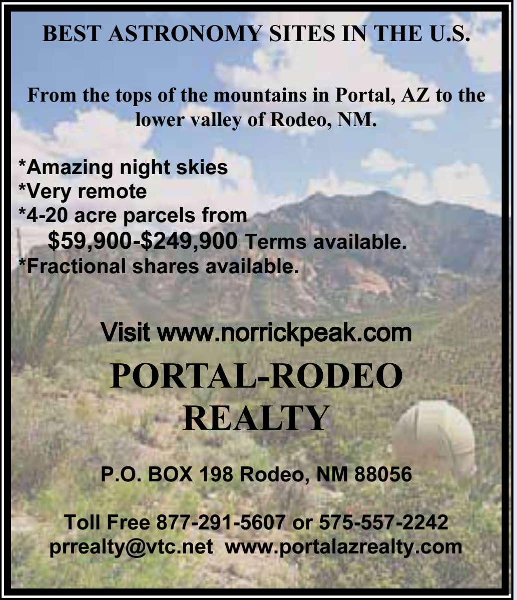

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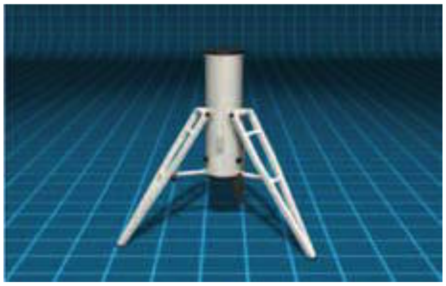

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